

Compressed Air

MAY 1956

Magazine



PHOTO, WESTERN WATER, INC.

POWER PLANT ON
THE SNOQUALMIE
Picturesque falls and hydro
station in Puget Sound
area of Washington

VOLUME 61 • NUMBER 5

NEW YORK • LONDON

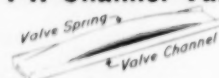
A SPACE-SAVING, READY-TO-GO



125 hp

TWO-STAGE AIR-COOLED MOTORCOMPRESSOR

- Easy to install
- No water jackets or piping
- No freezing problem
- Air cooled intercooler
- Constant speed or dual control
- I-R Channel Valves

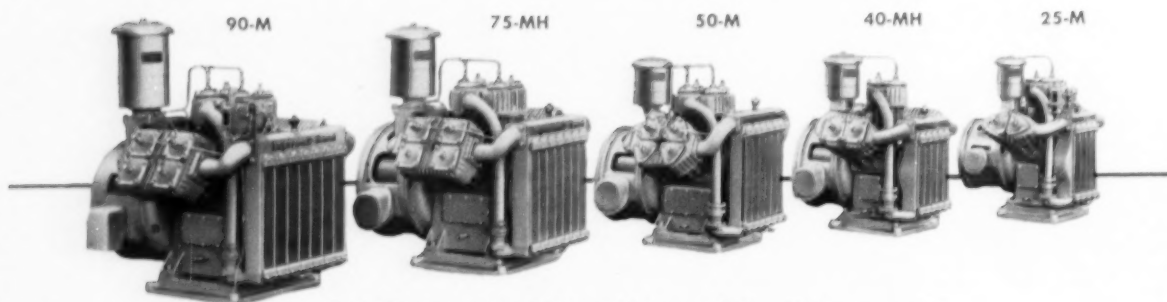


High Efficiency
Quiet Operating
Exceptional Durability
Entirely Different
Stainless-steel Channels and Springs
Air-cushioned action
Found only on I-R compressors

Newest addition to the Ingersoll-Rand line of Type 40 compressors, this heavy-duty, air-cooled unit offers new convenience and economy for the generation of 80-125 psi air power in the 125 hp class. Shipped fully assembled, its compact, well-balanced design and small foundation requirements cut installation costs. And efficient two-stage compression with intercooling to near ambient temperature, reduces power costs all year around.

Choice of constant-speed control, automatic start-and-stop control and manual or automatic dual control affords the most efficient capacity regulation for your particular operating requirements.

For complete information on all the time-saving, cost-saving features of this 125-hp Motorcompressor, send today for your copy of Bulletin 3188.



These sizes complete the Type 40 range of air-cooled compressors

Ingersoll-Rand

1-403

11 Broadway, New York 4, N. Y.



COMPRESSORS • GAS AND DIESEL ENGINES
ROCK DRILLS • PUMPS
TURBO-BLOWERS • AIR AND ELECTRIC TOOLS

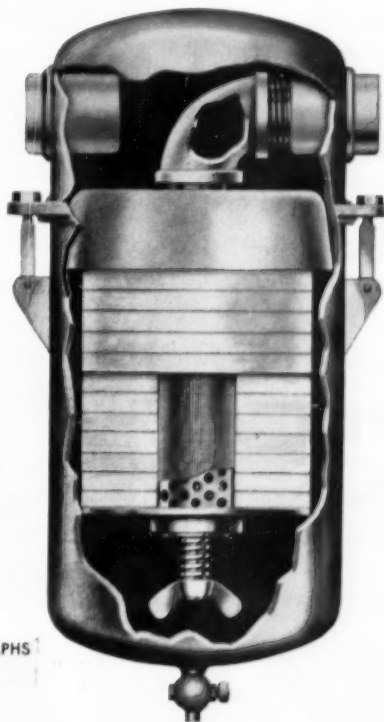
Circle 1A on reply card



MOISTURE FROM RUINING YOUR AIR- OPERATED EQUIPMENT

GET **STAYNEW** ABSORPTION FILTERS

Moisture, oil, and foreign matter can raise havoc in your compressed air lines. That's why Staynew Absorption Filters were designed. Thousands of manufacturers from coast to coast have eliminated process shutdowns and are now saving thousands of dollars annually since installing Staynew Absorption Filters. If you have air-operated equipment or processes you owe it to yourself to get all the facts on Staynew Absorption Filters.



Model AAPHS

DOLLINGER
PROTECTION
STAYNEW FILTERS
DOLLINGER
CORPORATION

ALL TYPES OF FILTERS FOR
EVERY INDUSTRIAL NEED



INTAKE
FILTERS



LIQUID
FILTERS



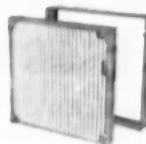
PIPE LINE
FILTERS



ELECTRO-
STAYNEW
PRECIPITATOR



AUTOMATIC
AIR
FILTERS



PANEL
FILTERS



SPECIAL
FILTERS

Write for Bulletin 200. Tell us about your special filtration problems. We'll be glad to help. Dollinger Corporation, Dept. 7, Centre Park, Rochester 3, N.Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCIOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

For Power that costs less to buy, run and **SPECIFY GM DETROIT DIESEL** in All Your Construction Equipment

YOU CAN BUY, run and maintain a General Motors Detroit Diesel for less than any other Diesel.

For a GM Detroit Diesel sells for less than other Diesels of comparable power.

It costs less to run because its fast 2-cycle operation gets more work done on a gallon of fuel—moves more yardage per day.

And hundreds of contractors tell us it costs less to maintain because it runs longer between overhauls. What's more, replacement parts cost less, too.

You can get GM Detroit Diesel power in practically every kind of construction equipment—it's *America's first choice Diesel*.

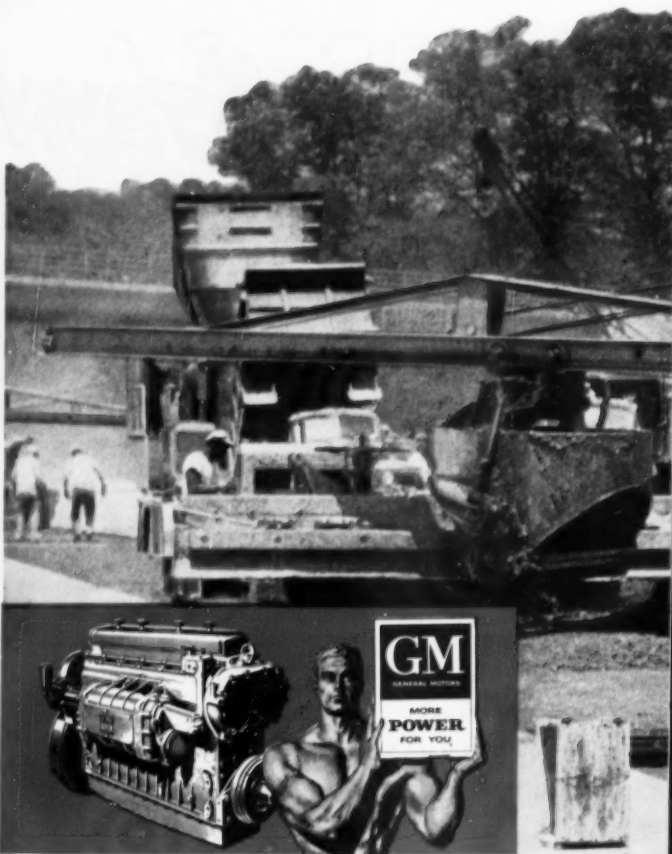
Call in your local GM Detroit Diesel distributor or dealer for full details on GM Detroit Diesel power. Do it soon—it can mean the difference between profit and loss on your next contract.

Single Engines ... 80 to 800 H.P. Multiple Units ... Up to 898 H.P.

DETROIT DIESEL

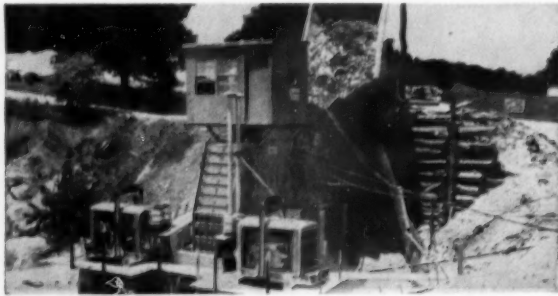
ENGINE DIVISION OF GENERAL MOTORS
DETROIT 28, MICHIGAN

America's Largest Builder of Diesel Engines



15,000 HOURS — ONLY \$150 FOR REPAIRS

Excavating Contractor Russell F. Davis of Lafayette, Indiana, put this GM Detroit Diesel-powered Northwest 25 in service in 1947, has spent only \$150 for repairs since. Now company owns three more excavators—all powered with quick-starting, fast-working GM Detroit Diesels.



"WE'VE STANDARDIZED ON GM DETROIT DIESEL"

Dependability, fast service, interchangeable parts—these are some of the reasons why Pennsylvania contractor, John S. Teeter & Sons, Inc., has standardized on GM Detroit Diesel power for crushers, pumps, generators and self-powered machinery.

maintain ENGINES

Parts and Service

As Near as
Your Telephone



Wherever your contracts take you, you'll find General Motors Detroit Diesel distributors and dealers ready to give you fast service and quick delivery of low-cost factory-engineered parts day or night.

For 165 GM Detroit Diesel distributors and dealers blanket the nation—still more are located in Canada and overseas—to help you keep your GM Detroit Diesels running right.

And when you call you get action, for these distributors and dealers know the need for speed on construction jobs—completion dates don't wait.

Typical of this speed is the experience of a contractor in West Virginia. He needed an engine overhaul on a scraper. His Detroit Diesel distributor had his scraper back on the job in two hours—because he pulled the engine and replaced it with a rebuilt unit, then took the original engine back to his shop for overhaul.

Another contractor hit subsurface water on an excavation—and his distributor kept the contract going by delivering GM Detroit Diesel-powered Wellpoint pumps in less than half a day.

And when you put your GM Detroit Diesel in the hands of your distributor's or dealer's servicemen, you're putting it in the hands of experts.

For they're factory-trained, know all the latest maintenance and repair procedures.

And they use factory-engineered replacement parts—the same parts, built to the same rigid specifications as the parts used in building GM Detroit Diesel engines.

For full details on the parts and service behind your GM Detroit Diesel, call your local GM Detroit Diesel distributor or write direct.

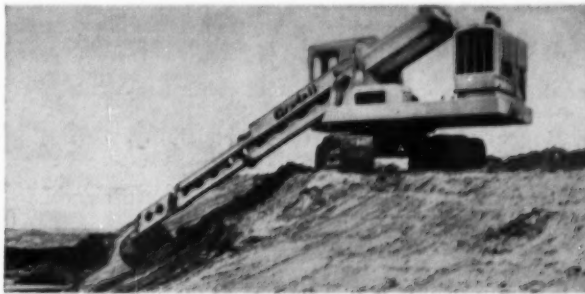
"STARTS QUICK—WARMSPUPFAST—PLENTY OF RESERVE POWER"

That's what Roy T. Jones, Project Manager of New York's John C. Peterson Paving Corp., says about the GM Detroit Diesels powering his two Multi-Foote concrete pavers. Company specified GM Detroit Diesel power to get low fuel consumption and high production—and they're getting it.



CRUSHES 280 TONS ON 90¢ FOR FUEL

Minnesota gravel contractor P. O. Pederson switched from a 4-cycle Diesel to a GM Detroit 2-cycle Diesel several years ago, has specified GM Detroit Diesel in two more crushers bought since then. Company reports GM Detroit Diesels start easy, work fast.



WINS \$1,143,835 JOB WITH GM DIESEL UNIT

This GM Detroit Diesel-powered Gradall's ability to do a faster job at less cost helped an Illinois contractor win a big contract in Oklahoma. In 400 days he cleared and grubbed 2,493,000 yards to widen and straighten a river and stabilize its banks.

In Nevada...And the World Over



Bucyrus-Eries get down to paydirt **FAST**

IN open-pit mines everywhere, Bucyrus-Erie shovels like this 6-yd. 150-B are demonstrating their ability to strip overburden and load ore fast and economically.

You can see *how* they do this as you watch them work — heaped dippers, smooth cycles, ease of control that cuts operator fatigue, plus year-after-year dependability.

You can see *why* Bucyrus-Eries are superior performers when you check their design and construction. The strong yet light front end reduces deadweight, saves power. Ward

Leonard electric control provides immediate response, permits time-saving coordination.

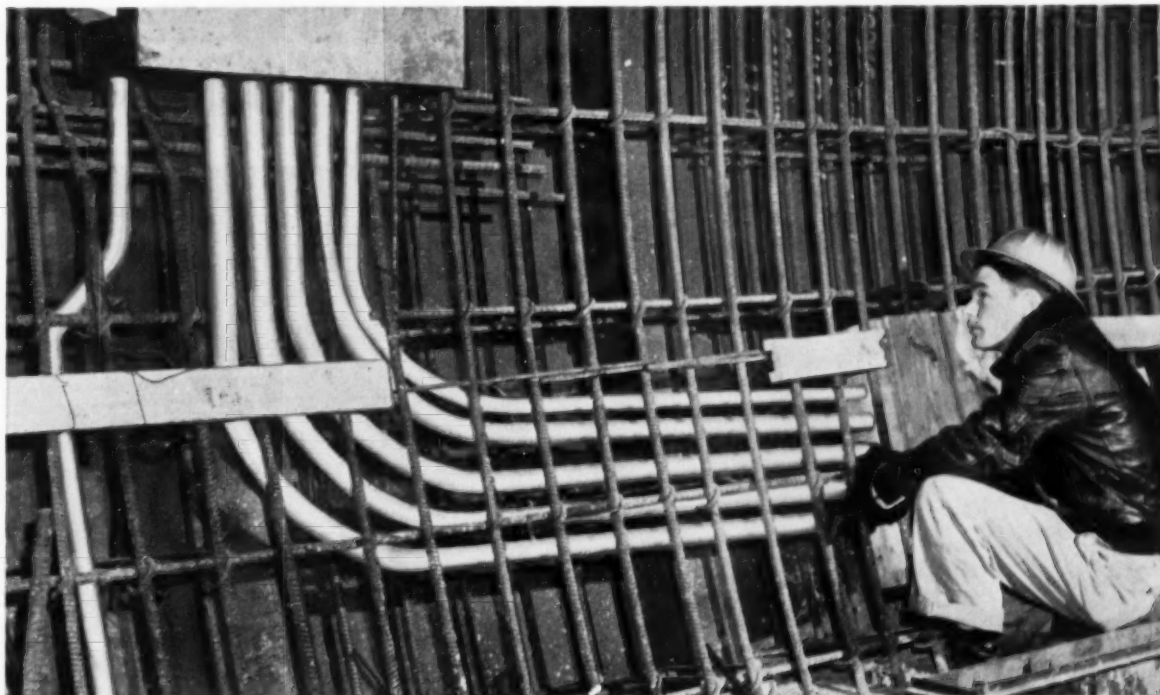
We would be glad to tell you more about Bucyrus-Erie excavators — how they can improve *your* operations.



BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN

Power for the new 7,650-foot Baltimore Harbor Tunnel will be protected by EVERDUR Electrical Conduit



Everdur Electrical Conduit, nominal size 1½", connecting control box to sidewalk manhole—all conduit to be embedded in concrete.



A section of Everdur Conduit in the roadbed slab protects the vital traffic control system and air duct lighting.

THE BALTIMORE HARBOR TUNNEL[†], under the Patapsco River, scheduled for completion in 1957, will be the largest "trench-type" tunnel ever built. Twin-tube sections are built on dry land, launched and concreted almost to zero buoyancy, then sunk in place and joined underwater by divers.

Power for traffic signals, alarms, air duct lighting, and shaft lighting circuits for this great tunnel will be protected by Everdur® Electrical Conduit—made from one of Anaconda's copper-silicon alloys. Everdur never rusts—offers high resistance to other types of corrosion. It provides dependable year-after-year protection—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete. Everdur is also tough—stands up under movement and vibration.

For detailed information, write: The American Brass Company, Buffalo Division, Buffalo 5, New York. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

*Reg. U.S. Pat. Off. 56155A

†Built by Maryland State Roads Commission; Merritt-Chapman & Scott Corp., General Contractors; Singstad & Baillie, Contracting Engineer; J. E. Greiner Co., Consulting Engineer.

EVERDUR ELECTRICAL CONDUIT

ANACONDA®

COPPER-SILICON ALLOYS

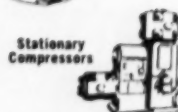
CORROSION-RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

MAY, 1956

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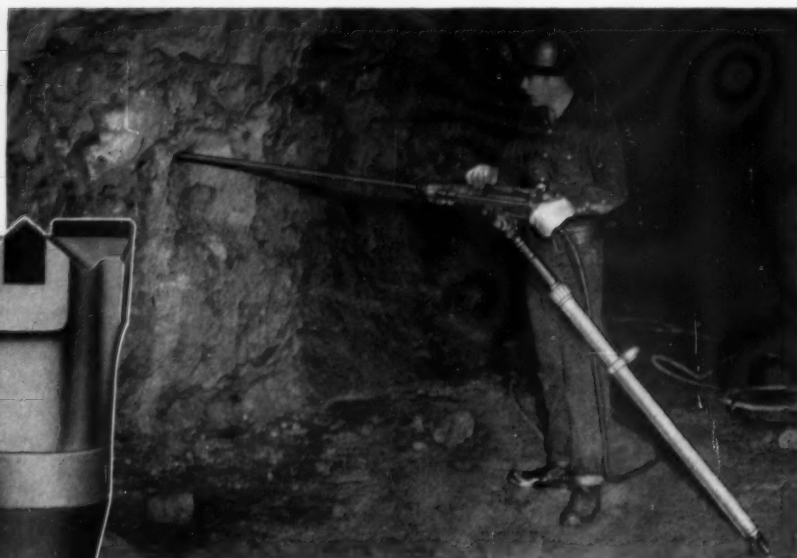
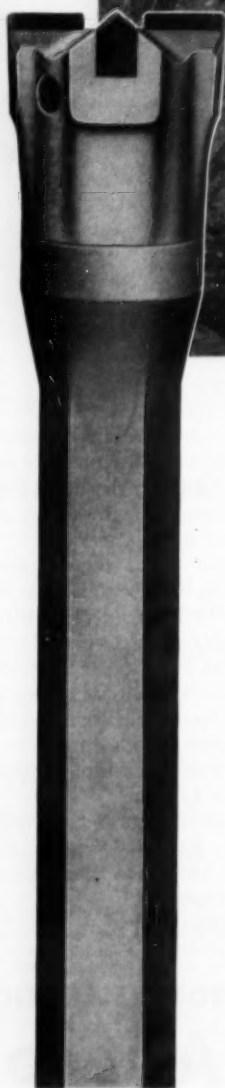
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ADV. 7



Carset Jackbits

DRILL FASTER and LAST LONGER



Carsets being used with JR38A Jackdrill.

INGERSOLL-RAND Carset Jackbits, with tungsten carbide cutting edges, have demonstrated cost saving performance on rock drilling jobs all over the world.

Carset Jackbits have *deeper Carbide Inserts* for more footage between grinds—more regrinds per bit. They have *more metal behind the inserts*, providing greater support and longer bit life. *Stronger skirt walls* and *greater bearing area* on the rod shoulders enable the bit body to stand up for the full life of the carbide inserts.

These longer lasting, faster drilling Carset Jackbits, together with Ingersoll-Rand's *complete line* of rock drilling equipment, give you an unbeatable combination for overall drilling efficiency. Your nearest I-R representative will be glad to help you pick the combination best suited to your needs.

Carset Jackbits are available in gauge sizes from 1¼" to 3½".

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

15-363

ROCK DRILLS • COMPRESSORS • AIR TOOLS • CENTRIFUGAL PUMPS • TURBO-BLOWERS • CONDENSERS • DIESEL AND GAS ENGINES

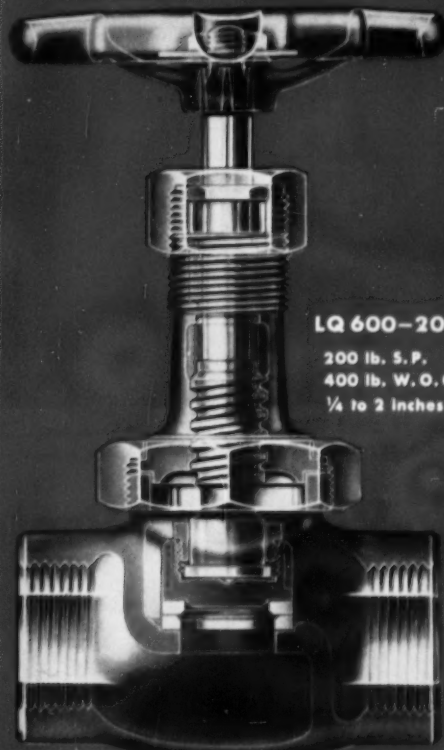
ADV. 8

Circle 5A on reply card

COMPRESSED AIR MAGAZINE

**Lunkenheimer
Announces
ANOTHER
GREAT NEW
LQ600
VALVE**

200 lb. S.P.! 400 lb. W.O.G.!



LQ 600-200

200 lb. S.P.
400 lb. W.O.G.
1/4 to 2 inches

Lunkenheimer's famous LQ600, the Bronze Globe Valve that set a new high standard of performance on 150 lb. service, is now available for 200 lb. S.P., 400 lb. W.O.G. applications. The new line features the same long-wearing flat seats and discs made of Brinalloy®, plus a body and bonnet of Lunkenheimer's amazingly strong S-1 Bronze for higher-pressure service. Install this great new LQ600 Valve on your 200-lb. pressure lines—including all your toughest services—and compare its performance with other valves. It's built to eliminate maintenance costs because there is no replacement of seats and discs—they are patented Brinalloy, brazed in to stay, harder all the way through and more resistant to wear and corrosion than 500 Brinell Stainless Steel and far exceeding the wear resistance of 1000 Brinell case-hardened Stainless Steel.

LUNKENHEIMER



Now there are TWO LQ 600 Valve Lines

The original LQ600 Valve for 150 lb. S.P., 300 lb. W.O.G. service has received the fastest acceptance of any valve introduced in years. Thousands of these valves are in service—some as long as five years—without a single reported case of failure or leakage.

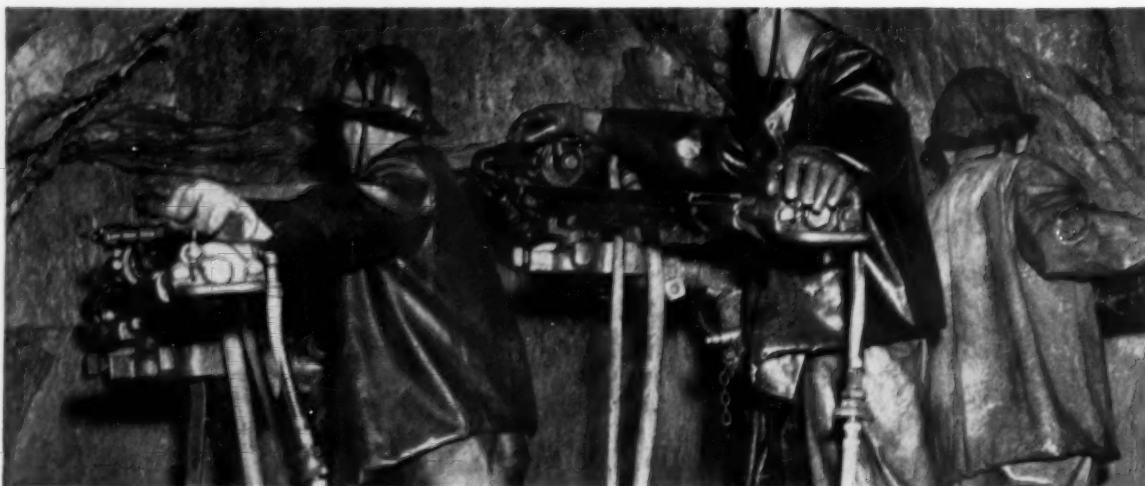
FOR COMPLETE INFORMATION WRITE....

The Lunkenheimer Company, Box 360,
Cincinnati 14, Ohio, or get in touch
with your Lunkenheimer Distributor.

BRONZE • IRON • STEEL • PVC

LUNKENHEIMER®

THE ONE *great* NAME IN VALVES



8,500-FT MINE TUNNEL IN IDAHO. Bethlehem Hollow provided standout performance during construction of a 10 ft x 11 ft bore, for which 33,000 cu yd of quartzite were removed, in lead-and-zinc mine at Burke, Idaho. Drifters are shown making 10-ft blast holes.

Rock-Removal Projects Across the Nation



TAILRACE FOR NEW DAM IN NORTH CAROLINA. About 1,000,000 cu yd of solid granite were blasted to make way for 8,000-ft tailrace, 80-ft wide, at Roanoke Rapids Dam, part of a huge hydroelectric project at Roanoke Rapids, N. C. Bethlehem Hollow, fitted with carbide-insert bits, was used in this rail-mounted drill carriage.

Shown here are several typical rock-removal projects, in widely separated sections of the country. They were selected at random from among hundreds of recent applications of that old reliable, Bethlehem Hollow Drill Steel.

Bethlehem Hollow Drill can always be counted upon for economical rock drilling, regardless of the nature of the application or depth of blast holes, because it is rolled from a tough, fatigue-resisting steel—steel that can take it.

We carry Bethlehem Hollow in stock in our mill depot in all commonly used sizes. You can also obtain it from your local converter. Give Bethlehem Hollow a workout on your next job. You'll like it!

BETHLEHEM STEEL COMPANY BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation



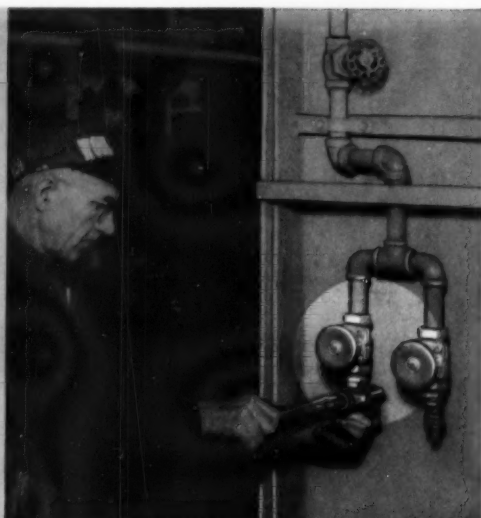
WATER-INTAKE TUNNEL BENEATH NIAGARA RIVER. Bethlehem Hollow Drill provided good service as contractor removed 9,200 cu yd of rock, most of it limestone, for 6,000-ft water-intake tunnel for Town of Tonawanda, N. Y. The new tunnel is about 100 ft beneath the Niagara River.



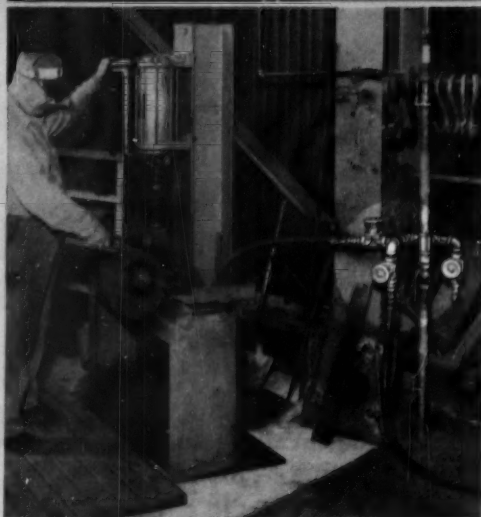
HIGHWAY RELOCATION IN ALABAMA. This battery of wagon drills, using 1-in. hexagon Bethlehem Hollow, fitted with carbide-insert bits, is shown biting into medium-hard limestone on Sand Mountain, near Gadsden, Ala. This highway contract called for the removal of about 150,000 cu yd of rock.

BETHLEHEM HOLLOW DRILL STEEL • CARBON AND ULTRA-ALLOY •

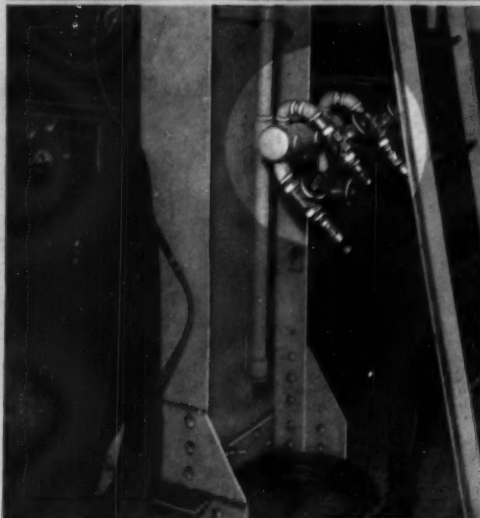
Hose outlets with quick coupling fittings attached to Grinnell-Saunders Valves at Lehigh Structural Steel Company.



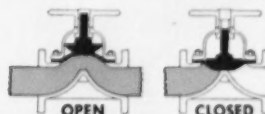
Outlet valves for this rod bender are Grinnell-Saunders.



4-outlet air manifold equipped with Grinnell-Saunders Valves.



"Lower air costs... increased productivity, with Grinnell-Saunders Diaphragm Valves"



At Lehigh Structural Steel Company, compressed air now goes to work—not to waste. Upon discovering that a large percentage of its compressed air supply was being wasted through leakage, this Allentown, Pa. firm began a major review and overhaul of its entire system. The main cause of the trouble was found to be in the outlet valves which could not be kept in proper working condition.

To determine which type valve would stand up best under prevailing service conditions, a number of different valves were installed and the results compared. Based on these impartial "on-the-job" tests, Grinnell-Saunders Diaphragm Valves were approved—and were installed throughout the entire system.

Here is another instance of the economy of Grinnell-Saunders Diaphragm Valves... in use by more and more industries where low maintenance, long service, and complete dependability are demanded.

Features: complete isolation of working parts, leak-proof closure even with grit or scale in line, high lift for full streamline flow, freedom from clogging, choice of diaphragm materials and body linings to suit service, and easy maintenance.



QUICK-ACTING, 1/4-turn bonnet

GRINNELL

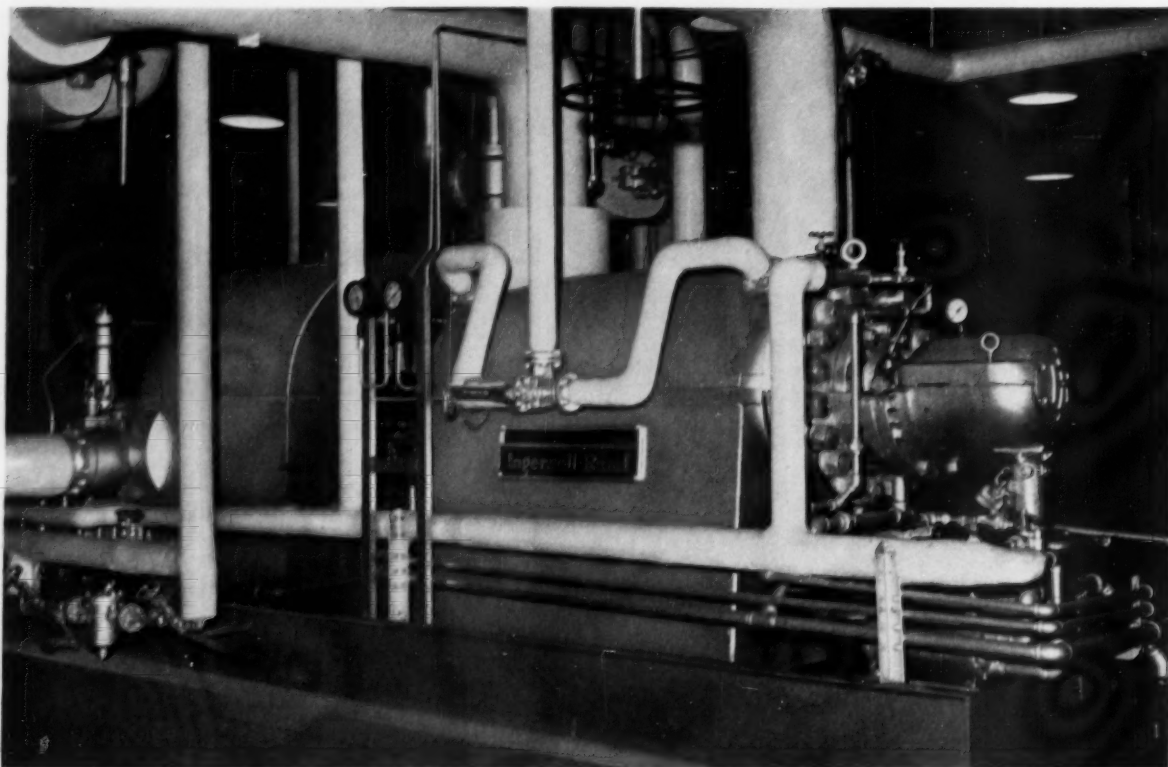
WHENEVER PIPING IS INVOLVED



Grinnell Company, Inc., Providence, Rhode Island

Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Great Northern Paper Co. gets

PERFORMANCE PLUS ECONOMY

with New I-R Boiler-Feed Pumps

At East Millinocket, Maine, the Great Northern Paper Company is completing a \$45,000,000 expansion program that will bring total mill capacity to 1,000 tons of newsprint per day. Constructed by Stone and Webster Engineering Corp., this mill represents the last word in modern paper-making methods and equipment.

In the new and completely modern power plant, boiler feedwater is handled by three identical Ingersoll-Rand 10-stage double-case pumps, each rated 757 gpm, 1554 psi discharge, 287°F. The cylindrical, double-case construction of these Class CHTA high-pressure pumps

simplifies maintenance, permits equalized thermal expansion of all internal parts and assures sustained high efficiency. This extra performance means long-range *economy* in heavy-duty service.

Other I-R Cameron pumps are also widely used throughout this ultra-modern mill. In fact you'll find the familiar I-R nameplate on more than 70 units in various plant and process services.

Whatever your liquid-moving requirements, there's an I-R pump that's *right* for the job. Any time you have a pumping problem, your Ingersoll-Rand representative will be glad to help you.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.



10-310

PUMPS • COMPRESSORS • CONDENSERS • DIESEL ENGINES • VACUUM EQUIPMENT • AIR AND ELECTRIC TOOLS



Tough Digging in Confined Areas

Eimco 105 Tractor Excavators can work efficiently in small areas because of their built in features.



These features permit the Eimco 105 to work in many places such as narrow ditch digging, tunnels, water channels, mines, railroad cuts, highway widening jobs and numerous others including basement excavation as shown above.

The Eimco 105 features include: (1) Independent track control so that one track can be run forward while the other runs reverse providing spin turns in the length of the machine, (2) Up front position of the operator for better visibility in confined areas, (3) Overhead bucket motion, to eliminate the

necessity of turning to discharge the bucket, (4) Simple easy controls, two small handles are all that control the motion of the tractor. Push for forward motion and pull for reverse motion.

Eimco 105 Tractor-Excavators are being used on construction jobs all over the world as well as in mines and quarries. These machines are operating longer periods at lower cost per yard loaded than any other equipment.

Investigate the Eimco Tractor-Excavator — it is the world's finest crawler tractor equipment.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A.

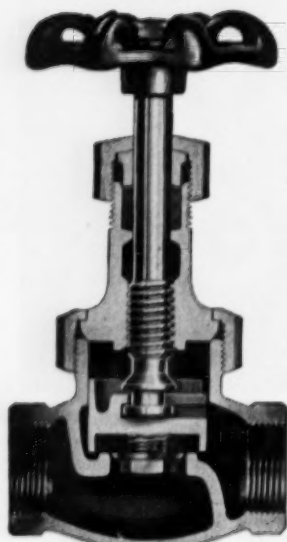
• Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

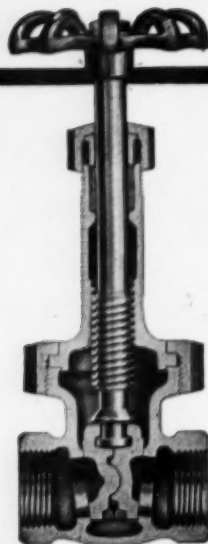


B-105

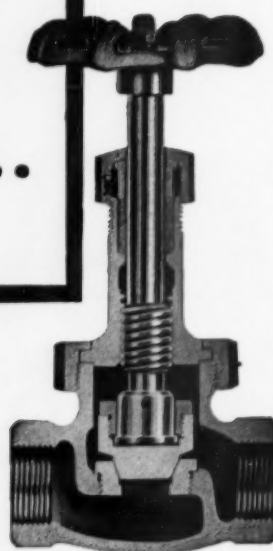
Walworth bronze valves...



Walworth No. 95 Globe Valve
Re-New-Disc



Walworth
No. 29 Gate Valve



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc

**built to give
dependable trouble-free service
on all recommended jobs**

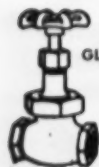
Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development — saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bon-

nets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, **TOUGHEST** bronze valves you can buy.

For full information about Walworth Quality Bronze Valves, see your Walworth distributor, or write:



GLOBE



GATE



ANGLE

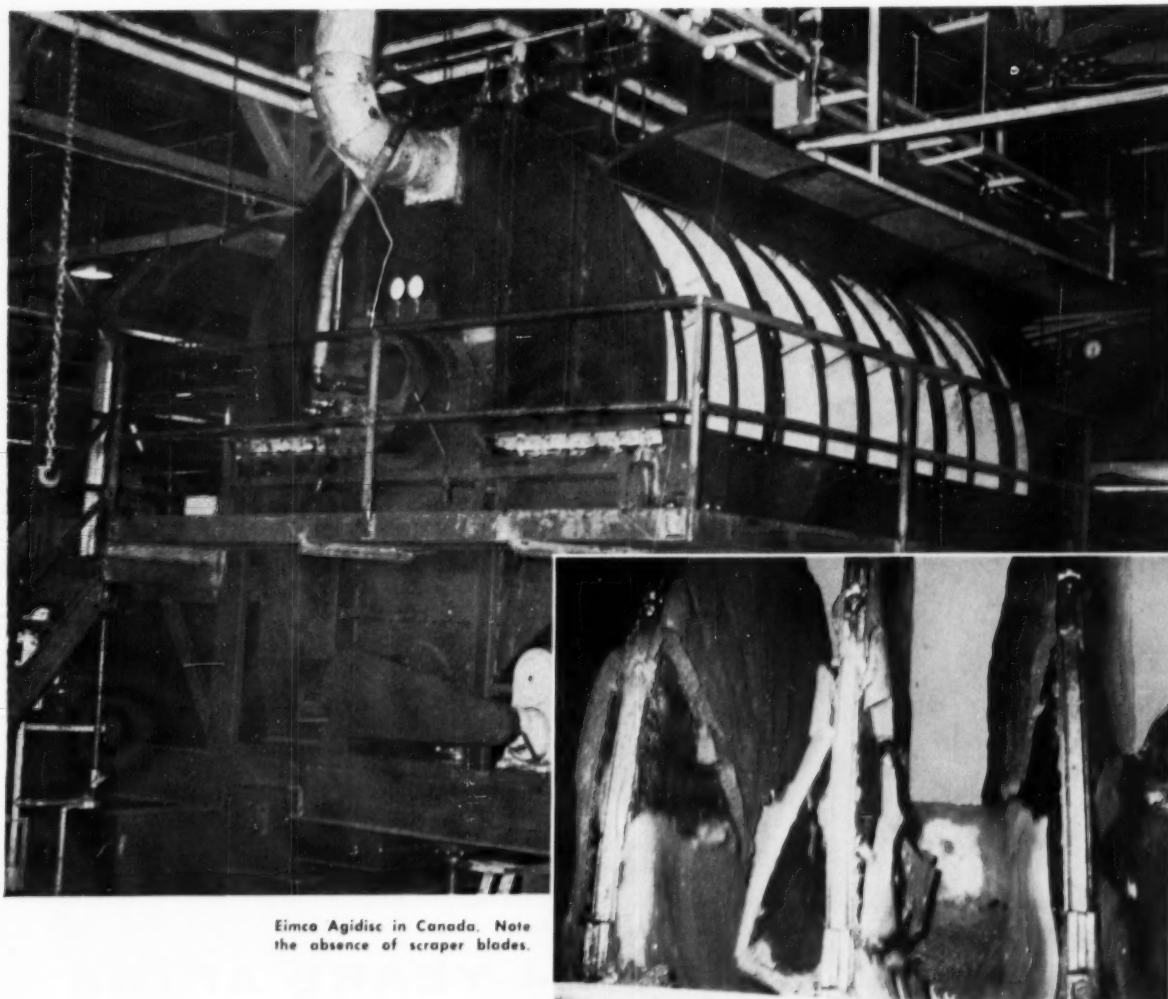
WALWORTH valves and fittings

60 EAST 42nd STREET

NEW YORK 17, N. Y.

CHECK





Eimco Agidisc in Canada. Note the absence of scraper blades.

HIGHER TONNAGES WITH EIMCO AGIDISC FILTERS

Eimco Agidisc filters work continuously and produce higher tonnages because Agidiscs keep the slurry agitated to optimum density throughout the tank.

The Eimco Agidisc produces a cake that is uniform in thickness over its entire surface, a cake with uniform dryness and has an even distribution of particle size. These characteristics have made it possible for one metallurgical plant to reduce the number of filters contemplated by one half. In another plant on a concentrate, the work done previously by seven filters is now done by four Agidiscs, and in another, one fourth the space occupied by four drum filters (unable to handle the flow) is now occupied by two Eimco

Agidiscs which handle the entire flow working about two-thirds capacity.

In addition to the tonnage, dryness and space advantages, Eimco Agidiscs can be equipped with snap blow for most applications. Note snap blow connection in valve of filter shown above and effect on cake (inset). The addition of this cake discharge attachment breaks the cake free of the filter media, prevents blinding in most cases, eliminates scrapers and increases the life of the media.

Eimco engineers will welcome an opportunity to demonstrate the increased savings in your plant through the use of Agidisc filters. Write for complete information.

THE EIMCO CORPORATION
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash.
Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa





ROCK DRILLING 24 YEARS AFTER THE COLORADO RIVER AQUEDUCT

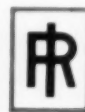
IT'S HARD to believe that just 24 years ago when work was started on the famous Colorado Aqueduct, forged drill steel was being used and steel Jackbits were just beginning to be noticed — that automatic drill feeds were just appearing — that there were no aluminum shells and 36-inch feeds were the longest in use.

Tunnel and rock men today use drilling aids only dreamed of by men who began the Aqueduct. The Ingersoll-Rand Carset Jackbit, probably the greatest single advance in rock drilling is now taken for granted. So are the

automatic-feed drifters with aluminum sliding cone shells, steel centralizers and time-saving, labor-saving hydraulic booms. These are all exemplified in the eight-drill jumbo shown above, which was used on the present Tri-Dam project in California.

Ingersoll-Rand has pioneered in the development of these and many other tools to speed up the removal of rock. Experienced sales engineers are ready to help you with *any rock-drilling problem*. There's an Ingersoll-Rand branch office near you.

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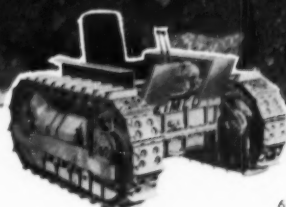


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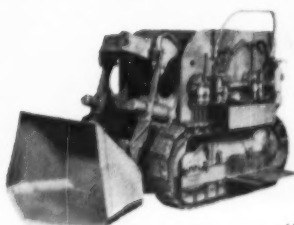
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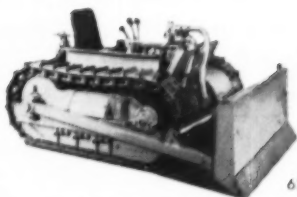
EIMCO 630's IN BIG STOPES



630 Tractor



630 Excavator



630 Bulldozer

Open stope mining has been the proving ground for numerous types of mechanical loading equipment. One type has replaced another as each succeeding piece of equipment has been able to show greater versatility, greater dependability and lower costs.

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Their reaction to the Eimco 630 Excavator has been enthusiastic. "We're re-ordering on the 630, it's giving us the lowest per ton cost and the highest production."

Eimco 630 Excavators have proven their dependability in mines and on contract jobs. Their heavy-duty construction has made them the lowest cost loaders used underground. They are easily controlled, fast in action and their loading speed averages three tons per minute in rock.

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The 630 is a rugged, hard working machine with a tough, carefully designed and precision made operating mechanism.

Lower your loading costs with Eimco equipment. Thousands of Eimcos are working every day wherever mining is done. You can depend on an Eimco.

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B-192

how to get the most out of HOLLOW DRILL RODS

Cutting drilling costs takes three things — quality drill steel, good shop practice, and care in the field.

The requirement of quality steel has been well taken care of by new *alloy* rods — Crucible CA DOUBLE DIAMOND and 4E Hollow Drill Rods. But even the best, toughest steel requires some care.

Take, for example, **FORGING AND HEAT TREATING**



Outside of breakage caused by down-right *abuse*, most hollow drill rod failures are caused by improper forging or heat treating.

Failures due to heat treatment are generally fatigue failures occurring in the region of the rod where the forging, normalizing or hardening heat runs out. This is the "soft-zone" between the part of the rod that is heated to the desired temperature and the part that remains cold. To eliminate unnecessary failures, it is important that manufacturer's data

sheets or field representative's recommendations be followed closely.

ANNEALING — If any forging is performed prior to machining, the end should be allowed to cool in air until black. It should then be reheated to slightly above critical temperature and allowed to cool slowly in a good insulating material such as mica or ground asbestos.

A good practice is to put the rods in the insulation early in the afternoon, and allow them to cool slowly until the next morning. When the rods are removed the ends should still be too hot to handle comfortably with the bare hands.

As a leading producer of drill steels, and other special purpose steels, Crucible welcomes the opportunity to work with you in solving problems as they arise.



Call your nearby Crucible representative for help with any phase of drill rod care or operation — or for *prompt* deliveries of hollow drill rods in the sizes, types and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

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ON THE COVER

THE Northwest, one of the nation's fastest growing sections, is generously endowed with sites for hydroelectric stations. As power and progress go hand in hand, there is a direct relationship between these statements. During the past two decades both public and private power developments in the area have sharply stimulated the growth of diversified industries.

Privately owned (14,900 stockholders) Puget Sound Power & Light Company serves about half the State of Washington. Its generating capacity is 238,000 kw in hydro plants and 85,000 kw in steam plants, and it has 7961 miles of distribution lines. The population of its service area rose 61 percent between 1940 and 1950, compared with 37 percent for all of Washington and 14.5 percent for the United States as a whole. To keep pace with the increasing demand, the company will expand its facilities by 50 percent during the next three years. Current construction includes an addition to its station at picturesque Snoqualmie Falls, shown on our cover. Another penstock and a second generator will raise the capacity there from 22,000 to 42,000 kw.

IN THIS ISSUE

THE nation's pioneer superhighway, the Pennsylvania Turnpike, continues to grow. Its latest link, the Northeastern Extension, will run northward from a point near Philadelphia to Scranton. Included is a 4138-foot tunnel being driven through the Blue Mountain ridge by Lipsett, Inc. Page 130.

AT PHOENIX, Ariz., AiResearch Division of the Garrett Corporation operates a new test facility for aircraft accessories that can duplicate all atmospheric temperatures and pressures they may ever encounter in flight. Included is a vacuum system that can withdraw up to 80,000 cfm of air per minute. Page 138.

SUPPLYING pure, cool air to workers in deep, hot mines is a serious problem. How it was solved in the Crescent Mine in Idaho is told on pages 140-42.

NEW YORK City's new \$35-million Coliseum can accommodate the nation's largest trade shows—page 143. Having standardized on air springs for its motor coaches General Motors is now applying them to trucks—page 145. The West's hottest tunnel since the Suro has gone into service after years of grueling construction work—page 147.

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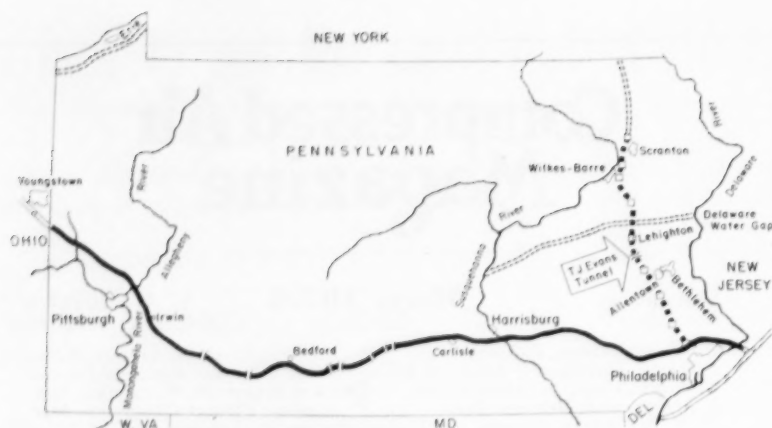
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TURNPIKE TUNNEL

PENNSYLVANIA TURNPIKE

With the state spanned from east to west (solid line with tunnels indicated) and connections established with the Ohio and New Jersey turnpikes, 47 miles at the south end of the Northeastern Extension (blocked line near right edge) is already open and the remainder, to run beyond Scranton, is under construction. Included is the T.J. Evans Tunnel, indicated by an arrow. Dotted lines show proposed future extensions now under engineering investigation.

How Lipsett, Inc., Is Driving the T. J. Evans 2-lane
Bore for the Pennsylvania Turnpike Commission

C. H. VIVIAN

THE commission that builds and operates the Pennsylvania Turnpike calls it "the world's greatest highway," and the description would seem to be appropriate. It is the oldest of the modern American toll roads and has served as a pattern for some of the later ones. Moreover, although its original section is almost sixteen years old, it has not remained static but, on the contrary, has kept on growing. Before this year is over its length will be approaching 500 miles, and plans now on the boards will increase this total by at least 50 percent within a few years.

The Pennsylvania Turnpike Commission was created by the Pennsylvania State Legislature on May 21, 1937, and given authority to construct, operate and maintain an all-weather east-west highway through the Allegheny Mountains. Forty months and ten days later, on October 1, 1940, the first 160-mile, 4-lane stretch between Carlisle, near Harrisburg, and Irwin, close to Pittsburgh, was opened to traffic.

The pay-as-you-ride road was successful almost immediately, and a 100-mile extension from Carlisle to Valley Forge near Philadelphia was begun on September 28, 1948, and placed in service on November 20, 1950. Thus, Pennsylvania's two largest cities, Philadelphia and Pittsburgh, and its capital, Harrisburg, were linked by the nation's most modern thoroughfare. When Ohio decided to construct an east-west turnpike running



NORTH PORTAL

Approximately 136,000 cubic yards of material was removed from the approach cut and in facing off the steep mountainside to get under cover. A double line of concrete cribbing offers protection against possible slides. Beyond the truck at the left is the skeleton of the ventilation building. There, and over the portal, forms are in place for concreting. Note the structure over the cab of the truck at the right. When the body is tilted upright into dumping position, this becomes a platform from which men can work overhead in the tunnel.

to the western border of Pennsylvania, the latter agreed to build a 67-mile connection from Irwin to a point on the state line not far from Youngstown, Ohio. That stretch was opened to traffic on December 26, 1951.

Then, in order to provide a similar link on the eastern end with the New Jersey Turnpike, which had meanwhile

been constructed, the Pennsylvania superhighway was extended 33 miles to the Delaware River and its final section was put in service on November 27, 1954. Nearing completion is a 6571-foot, 6-lane bridge across the Delaware that will effect the juncture. Its opening is scheduled for May 25.

The Pennsylvania Turnpike thus



PHOTO, ALLENTOWN (PA.) CALL

GENERAL VIEW INSIDE NORTH PORTAL

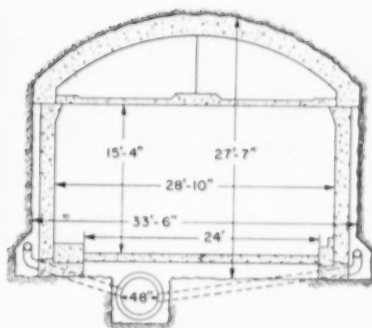
In the foreground the roof is supported by steel sets spaced 4 feet apart. Beyond them is a stretch that required no support other than a few rock bolts in the roof. In preparation for pouring the concrete lining corrugated steel sheets have been erected along the sides. The space behind them will be filled with crushed stone, and 18 inches of concrete will be placed between the sheets and moving forms. Along the left wall is a 48-inch pipe that carries ventilation air to the heading from blowers at the portal. On top of it is an 8-inch compressed air line.

spans the state lengthwise with 360 miles of continuous, divided, concrete-surfaced highway having long, sweeping curves and maximum grades of 3 percent. Even before the final link was forged the commission was fashioning its first north-south connecting stretch. This route ties into the older line at Plymouth Meeting, northwest of Philadel-

phia, and runs almost due north to a point a few miles beyond Scranton, the anthracite coal capital. Ground was broken in the Pocono Mountains on March 25, 1954, and work has been underway ever since.

In general, the letting of contracts, beginning on March 9, 1954, proceeded from south to north, with the result that the 37-mile section from Plymouth Meeting northward to Lehigh Valley Interchange, near Allentown, was opened on November 23, 1955. A little later an additional 15-mile section was put in service, extending to a temporary interchange in the Slatington area, a short distance south of the Mahoning Valley Interchange. This entire Northeastern Extension, as it is known, will be finished late this year.

For the past eight months engineering studies have been in progress for the first section of the Northwestern Extension, a proposed stretch of approximately 46 miles along the shore of Lake Erie in the extreme northwestern corner of Pennsylvania. It will proceed from the western end of the New York Thruway to the Ohio-Pennsylvania line. Still other extensions either have been authorized or are under consideration, and when all are completed the total length of the system will be 750 miles, making what is expected to be the world's foremost superhighway network.



CROSS SECTION

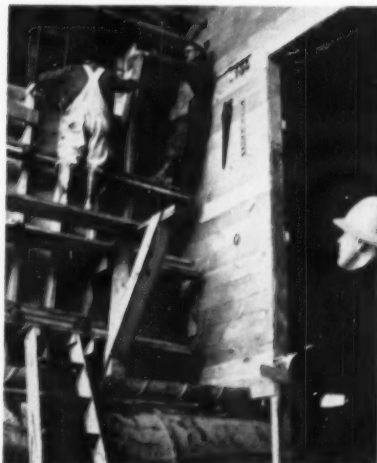
The concrete lining will have a minimum thickness of 18 inches on the walls and 24 inches at the arch. The paving slab will be 10 inches thick and the ceiling slab 6 inches. The spaces above the ceiling will be passageways for ventilating air. The 48-inch drainage pipe running under the floor will receive water from regularly spaced laterals extending from smaller collector pipes outside the concrete.

The initial 160-mile section owes something to the pioneer engineers who visualized, surveyed and partly built the old proposed South Pennsylvania Railroad which was planned by William H. Vanderbilt, chief owner of the New York Central, as a competing line with the Pennsylvania Railroad between Philadelphia and Pittsburgh. Its route, finally chosen in 1883 after years of field work, was considered the shortest practicable one through the mountains.

Helped financially by steel magnate Andrew Carnegie, Vanderbilt spent \$10 million in two years and completed 60 percent of the grading and a slightly greater percentage of the driving of the nine tunnels that were to carry the line through successive ridges of the Appalachian Mountains systems. At that stage Vanderbilt and the Pennsylvania interests suddenly made peace, with the latter buying the embryo railroad. Construction was halted forthwith, and the South Penn Railroad scheme was abandoned. The right of way remained in the possession of the Pennsylvania and the Baltimore & Ohio railroads until it was purchased by the Pennsylvania Turnpike Commission.

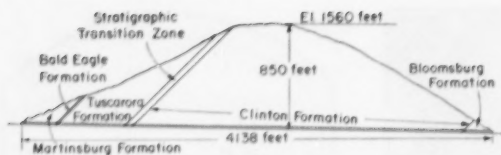
That unfinished rail path became the foundation of the nation's first superhighway. Seven of the partly bored tunnels, with a combined length of 35,000 feet, were incorporated in the route, finished, lined with concrete and provided with illumination and ventilation systems. The longest is Sideling Hill (6782 feet) and the shortest Ray's Hill (3532 feet). No more tunnels were called for in the Turnpike construction program until the current Northeastern Extension was laid out. It includes a 4138-foot bore through the Blue Moun-

(Continued on page 134)



FORM WORK

Carpenters putting up forms for the concrete wall of the ventilation building just outside the north portal.



PROFILE

Showing geological formations to be penetrated. The south portal is at the left end and the tunnel descends slightly toward the north portal.



DIFFICULTIES AT THE SOUTH PORTAL

Here the crews are fighting their way into the mountainside inch by inch through bad ground.

1 The deep approach cut and the series of benches formed above and around the portal to arrest sliding.

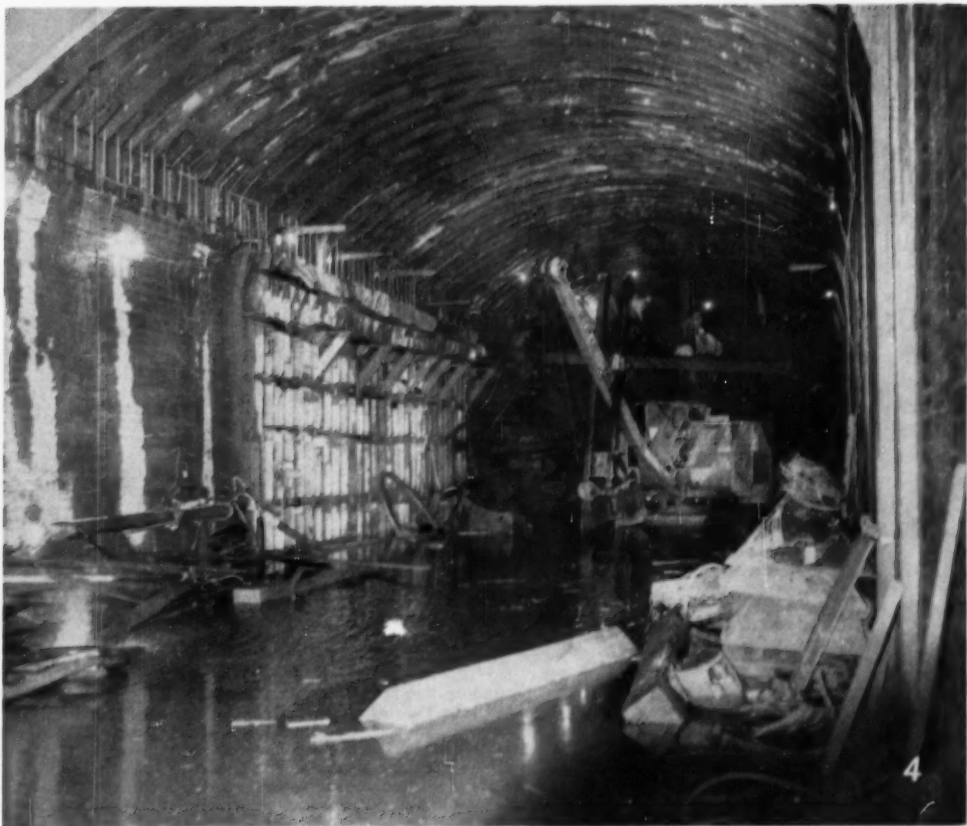
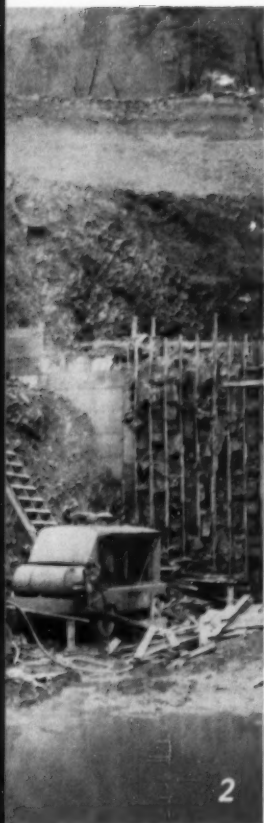
2 Close view of the unstable slaty-shale rock. Two Gyro-Flo portable compressors at the right, discharging into the storage tanks above them, supply compressed air for the operations.

3 This is the second portal—established after the rock roof over the section in the foreground had caved in. This approach stretch will be roofed over with concrete and covered with earth before the tunnel goes into use.

4 Workmen in the top heading and power shovel at the base of the bench. The water came in from outside on a rainy day. Forms at the left are still in place on freshly poured concrete.

5 Close-up of the top heading, which is about 7 feet high. Little blasting is required, and the men are able to gouge out most of the loose rock with paving breakers. Note the continuous steel roof that is put up as the tedious work advances.





tain ridge a short distance north of the present temporary terminus. The remainder of this article will deal with the tunneling operations there and a later one will give further details on the construction of the remainder of the Northeastern Extension.

Called the T. J. Evans Tunnel—for a former member and chairman of the Turnpike Commission—it lies partly in two counties. The southern portal is in Washington Township of Lehigh County and the northern portal in East Penn Township of Carbon County. The horseshoe-shaped bore is being excavated 33½ feet wide and 27 feet 7 inches high between pay lines. Inside the concrete lining, which will have a minimum thickness of 18 inches, the distance between curbs will be 28 feet 10 inches. The roadway will be 24 feet wide and separated into two lanes by a 13-inch cast-iron marker strip. There will be a clearance of 15 feet 4 inches between the floor and the ceiling and the space above the latter will be divided by a central vertical member into two passageways for ventilating air. Underneath the roadway will run a 48-inch-diameter drainage pipe with laterals at regular intervals from 8-inch pipes in the base of each wall.

The contractor is Lipsett, Inc., of New York City, well known there and in Philadelphia for heavy construction and demolition work. It recently completed construction of the Kingston Underpass, Woodland Subway, Willow Grove Hangar and Vine Street Bridge in Philadelphia and the razing of the Third Avenue Elevated Railway structure in New York. The tunnel was designed by the New York engineering firm of Parsons, Brinckerhoff, Hall & MacDonald, which is also supervising its construction. Work was started in September 1955, and is scheduled for completion not later than next December.

Following the original plan, the contractor is driving the major portion of the tunnel from the north portal, taking advantage of the slight descent toward that end to reduce the amount of pump-

ing required. Generally sound rock has been met on that end and the heading is now in more than 2600 feet and moving ahead steadily. On the other hand, bad ground at the south end has so hampered the crews that they are only now getting well started.

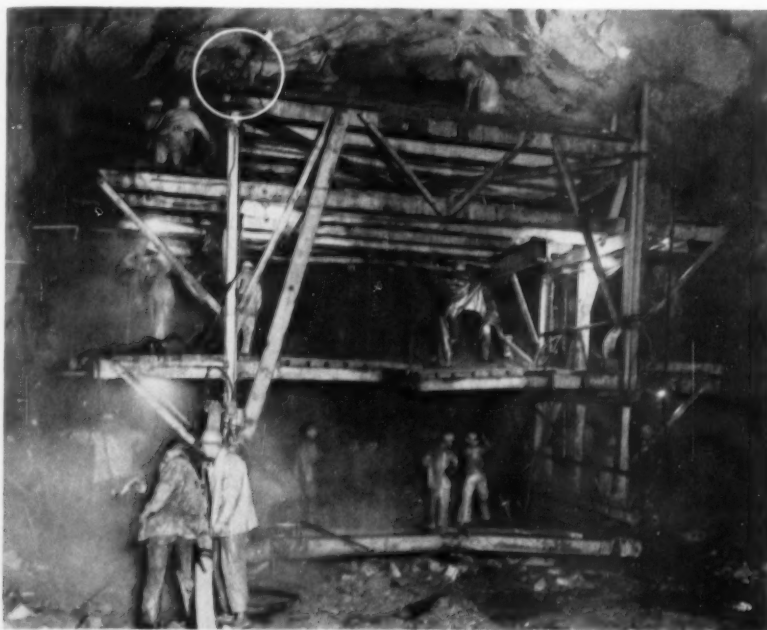
The mountain being penetrated is composed of consolidated and somewhat altered sediments that were laid down during Ordovician and Silurian geological periods, which classes them among the older rocks in the country. As an accompanying sketch shows, the greater part of the tunnel (approximately 3000 feet) will pass through the Clinton Formation. This is predominantly red or gray sandstone and quartzite that stands well and causes little trouble. The north heading is now in the Clinton and will next enter the Tuscarora, about 600 feet thick and also made up largely of sandstone and quartzite.

At the two ends are shale formations, the Bloomsburg on the north and the Martinsburg on the south. The former wasn't very troublesome, but the Martinsburg has made up for it in full measure. All the formations dip to the south, with the angle gradually increasing from about 30° at the northern end to around 45° at the southern end. In addition to the predominating shale, the Martinsburg also contains some slate. Both of these rocks are highly impervious, and

the water which enters at the surface flows down the bedding planes along the dip and remains in the numerous openings of the rather badly broken up material. The moisture acts somewhat like a lubricant, and where the tunnel is being driven against the dip of the beds the loose material tends to slide down into the opening. The approach to the south portal is in a long and deep cut, and there was evidence there of the unstable nature of the ground.

The tunnelers there had advanced only about 80 feet when the roof collapsed even though steel sets had been erected every 4 feet. Hundreds of tons of badly fragmented material came in and had to be cleared away. The cave-in necessitated rebenching the area of the steep slope above and at each side of the portal. This entailed the removal of an additional 45,000 cubic yards of material.

Because of the length and depth of the approach cut at this end and the quantity of hillside scaling that had to be done in getting underground, the excavation in the area amounted to approximately 525,000 cubic yards. This compares with 136,000 cubic yards at the north portal—also a heavy job. It is significant to note that their total of 661,000 cubic yards is roughly five times the estimated 133,000 cubic yards to be removed from the tunnel proper.

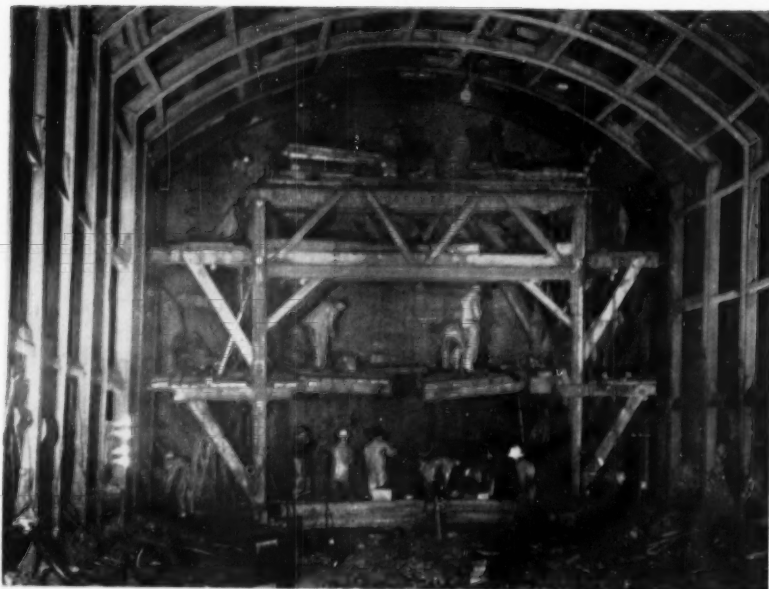


BROTHER DRILL TEAM

During drilling operations in the north heading about 30 men swarm over the jumbo. In the view above they have just started a round (those at the left are partly obscured by fog coming from the drill exhausts). Circled at the top-left is an air hoist that takes care of miscellaneous lifting jobs. Left, John and Charles Zahora, brothers, man one of the 14 or 15 Ingersoll-Rand IR-38A lightweight jackdrills that are spearheading the drive through the mountain. They, like most of the 375 men employed, come from the nearby anthracite mining section and are accustomed to underground work.

PHOTO, ALLENTOWN (PA.) CALL





LOADING BLASTHOLES

Working from the drill jumbo and the ground, the crew is loading a round of 110 holes drilled in the rock face. The picture shows how the steel sets—spaced 6 feet apart at this point—are carried close to the heading.

Upon the second attempt at establishing the south portal, the spacing of the steel sets was reduced to 2 feet instead of 4. Even so, it was soon apparent that the steelwork was taking considerable weight from overhead, so the crews retreated to the portal and began placing the concrete lining. Then they adopted a top-heading-and-bench attack, proceeding with great caution. They are still following this course, with the top heading in about 200 feet and the bench 150. Hardly any drilling is required, and at times the broken rock in the face of the bench slides down to the foot. On one occasion about 40 cubic yards fell away.

Although the extent of these difficulties could not be foreseen, adverse conditions had been predicted by the geologists as a result of their diamond drilling and other preliminary engineering investigations. In several instances continuous cores could not be extracted in this area because of the broken nature of the rock. The geologists also warn of possible additional trouble a little farther ahead where the tunnel will run out of the shale. Cores taken there indicate that the water held and backed up by the impervious shale has leached some of the sand and cementing material from the sandstone and conglomerate of the neighboring Bald Eagle Formation. As a result, the latter is expected to be like loose sand in some places. Only a short stretch of this is anticipated, however (the Bald Eagle is only about 10 feet thick there), and sound rock is looked for in the Tuscarora Formation, which is

probably less than 100 feet in from the present heading.

Because of the conditions outlined there has so far been little need for compressed air at this portal, although two Ingersoll-Rand Gyro-Flo portables—a 600 cfm and a 315-cfm—are stationed there. Paving breakers are being used to some extent in the poorly consolidated rock, but there is little work for drills. An Insley shovel loads the muck into trucks for disposal. The tunnel enters this portal on a downgrade, which lets

water accumulate inside. Two I-R air-powered sump pumps have proved helpful in removing it. They are of a new design with pressure lubrication and hardened bearings and stand up well in the grit-laden water that has caused some other types to undergo major overhauls after about two weeks of service. Compressed air has also been brought into play for vibrating concrete poured in curbs, footings, etc. There are five Type IV vibrators on the job.

The north heading is being driven full face with the aid of a steel-frame carriage or jumbo. It is the second one utilized, its predecessor, built by Robert S. Mayo of Lancaster, Pa., having succumbed to the battering of rocks pried down from overhead. The one now in service was constructed on the job. It has one pneumatic-tired wheel at each front corner; that is, next to the drilling face. There are no wheels at the rear, but in the center of the bottom steel cross-member there is a pin-type coupling similar to the kind used with automobile trailers. To move the jumbo away from the face a tractor is backed up and connected to the structure, thus raising the front end off the ground to haul it out of the way. The tractor backs up to return the carriage to the heading for scaling the walls and roof, setting steel and drilling.

Drillers work both from the jumbo's two wooden platforms and from ground level. They use either 14 or 15 Ingersoll-Rand Jackdrills, each of which consists of a 63-pound JR-38A Jackhammer mounted on a pneumatic leg or column. An entire unit weighs only about 100 pounds and can be lifted and shifted readily by one man. Consequently, they require no "setup" time and permit the utmost flexibility of operation with vir-



PERSONNEL

At the left end is Joseph L. Thomas, general superintendent, and next to him is Michael Carey, project engineer. At the extreme right is James Sullivan, north-portal superintendent. All are with Lipsett, Inc., the tunnel contractor. Third and fourth from the left are Harold Wambacker, resident engineer, and Evar J. Forslund, assistant resident engineer, for Parsons, Brinckerhoff, Hall & MacDonald, the New York firm that designed the tunnel and is supervising its construction. Second from the right is Alden E. Cornell, inspector, representing the Pennsylvania Turnpike Commission. The picture was taken near the north heading.



tually no lost motion. If one or more drillers in a certain area encounter trouble, others who have completed their quotas of holes can move in and help out. Thus, threatening delays can usually be overcome quickly. Because the weight of the drill is borne by the pneumatic column, the operator exerts little physical effort.

There are approximately 110 holes in a normal round. The central converging cut holes are currently being drilled 12 feet deep and all others 10 feet, which results in an advance of approximately 9 feet from each blast. The machines use 1 3/8-inch-gauge Carset (tungsten carbide-insert) bits on 3/8-inch hexagonal alloy-steel rods. An average of 560 feet of hole is drilled with each bit. When dulled, they are resharpened on a pedestal grinder mounted on a bench. From 45 to 75 bits are used per round, depending on the type of rock. The quartzites that must be penetrated for about 70 percent of the way wear bits fast. As many as 210 have been reconditioned in 24 hours of drilling.

Holes are loaded with from 600 to 650 pounds of Hercules Gelamite explosives of 60 percent strength for the cut holes and 40 percent for the others. Firing is done electrically with ten delays. Mucking is handled by a Bucyrus-Erie 38B 1 1/2-cubic-yard electric shovel that has a shortened boom and dipper stick and dumps into 12-yard Euclid trucks driven by diesel engines having scrubbers on their exhausts as safeguards against contamination of the atmosphere. Empty trucks are turned around when within 200 or 300 feet of the heading and back in the rest of the way to receive their loads. As there isn't room to turn in the normal manner, the maneuver is performed by the following simple method:

At the turning location, steel plates are laid along the right side of the tun-

nel, extending out to about the center line. As a truck approaches this point the driver stays close to the left wall and then swings his vehicle as far to the right as possible in the limited space, stopping it with the front wheels on the edge of the skid plate nearest the heading. A wire rope extending from an Ingersoll-Rand HU air hoist spragged to the floor close to the right wall at the opposite end of the plate is then hooked onto the front of the truck. As power is applied at the hoist, the driver jockeys or jiggles the wheels and the front end is drawn far enough along the smooth steel surface to permit completing the turn-round under the vehicle's own power. The turning "props" are moved ahead periodically as the tunnel face is advanced.

A complete cycle of operations at the heading takes about ten hours, which is at the rate of approximately five rounds every 48 hours. The timetable of a typical cycle reads something like this: drilling, 1 3/4 hours; loading and blasting, 1 hour; exhausting smoke and fumes from heading and blowing in fresh air, 3/4 hour; barring down loose rocks from overhead, 1/2 hour; mucking, 4 to 4 1/2 hours; setting steel, 1 to 2 hours. Where no steel support is required the time can, of course, be reduced.

For the first few hundred feet in from the portal steel sets were erected on 4-foot centers. Then there is an unsupported stretch of 400 feet where a few rock bolts were placed in the roof with the aid of two R-38A Stopehamers and a Size 534 Impactool. This is followed by 1650 feet with steel sets 4 feet apart. From there to the heading they are on 6-foot centers. The sets are made up of 8-inch H-beams, the legs weighing 35 pounds per foot and the ribs 40 pounds per foot.

Steel is put up during each cycle just prior to drilling, the jumbo being brought

MOVING THE JUMBO

To move the drill carriage back from the heading during blasting and mucking operations a tractor backs up to it (left) and is coupled to it by means of a pin-type connection (below). With the rear end lifted clear of the ground the structure travels on two pneumatic-tired wheels mounted on the forward corners.



up to the working face for that purpose. An I-R air-powered hoist of 1250 pounds lifting capacity, mounted on the upper left-rear corner of the structure, assists in raising steel and serves to handle the center-hinged sections of the lower platform that are let down so the shovel and trucks can pass through when the carriage is away from the heading. When steel supports were placed 4 feet apart two sets were put up during each cycle; now that they are being spaced on 6-foot centers one set is erected during one cycle and two sets during the following one.

In excavating the trench for the drainage pipe, closely spaced holes are drilled in line on each side with two DB-35 drifters on one pneumatic-tired wagon mounting. Several J-40 Jackhammers are also used in this work and for miscellaneous drilling, and the surveyors have a lightweight J-10 Jackhammer to drill holes in which to set their pins. Six new I-R paving breakers and several older models are used for trimming walls during steel erection and also serve other purposes.

New drill rods used for starting holes in the heading are 12 feet long. None less than 5 feet long can be used there, so when they are worn down to that length they are transferred to the Jackhammers, which are equipped to take the same shanks.

Initially and until recently compressed air was supplied at the north end by four Ingersoll-Rand Motorcompressors. Each is driven by a 125-hp direct-connected motor and delivers 540 cfm of air at 100 psi pressure. Their combined output of

2160 cfm was just about sufficient to meet the needs, assuming no leakage in the delivery lines or at the tools. Each drill on the jumbo consumes 110 cfm, or a total of 1650 for fifteen of them. When the normal number of drifters, Jack-hammers and paving breakers are in action the total air requirement is 2360 cfm, aside from that used to operate the hoists.

As the distance to the heading lengthens, friction in the 8-inch Naylor Spiral-weld delivery line and connecting hoses increases and progressively reduces pressure at the drilling face. In anticipation of this condition, an I-R 600-cfm Gyro-Flo originally assigned to the south end was moved several weeks ago and held ready for service when needed. It was tied into the system about April 1, raising the output to 2760 cfm.

Lining of the sides and roof with concrete was begun late in March, starting at the portal and working inward. The floor will be poured later. Collapsible Blaw-Knox forms, 37 feet 9 inches long and traveling on wide-gauge rails, are being used, and the schedule calls for placing two lengths daily, either walls or roof.

Concrete is mixed in a plant having a daily capacity of 480 cubic yards and is delivered to the forms by a Pumpcrete machine. Forms for side walls are taken down 24 hours after pouring; roof forms



SOURCE OF AIR POWER

Fronts of four Ingersoll-Rand 125-hp Motorcompressors that supplied all the air at the north portal until recently, when a 600-cfm Gyro-Flo rotary portable unit was tied into the line.

remain up 48 hours. Where supporting steel is located, corrugated sheet steel is erected immediately behind it to serve as the outer retaining wall for the concrete. The space between the latter and the rock wall is filled prior to concreting with crushed stone, which is elevated and dropped over the top by a Haiss elevator. In unsupported stretches the entire space between the forms and the wall is filled with concrete.

The roadway on which future motorists will glide through the tunnel will consist of a 10-inch slab of concrete laid on a 6-inch subgrade of crushed rock underlain by at least 8 inches of prepared subbase. The walls will be tiled. Buildings to house ventilation equipment are being built at each portal by Lipsett, Inc., under a separate contract. Blowers installed in each one will force up to 237,000 cfm of air through the overhead conduits from which it will enter the roadway space below via regularly spaced openings. Vitiating air will be expelled from the portals. The blowers will be reversible, however, making it possible to draw air through the openings and out by way of the overhead channels whenever desired. The ventilating equipment will include a carbon-dioxide analyzer to give warning of excessive contamination of the tunnel atmosphere.

Motorists traveling north on the Northeastern Extension will emerge from the tunnel on a steep slope high above the Lehigh River. There, on clear days, a fine view of the valley will unfold with Palmerton a little downstream. As the highway continues northward, it will descend into the valley and cross the

stream a short distance from Lehighton.

T. J. Evans, for whom the tunnel is named, is called the grandfather of the Pennsylvania Turnpike. He was a member of the Turnpike Commission for sixteen years and its chairman for twelve. His home is in the anthracite region that will benefit from the Northeastern Extension, and he was instrumental in promoting its construction.

The Pennsylvania Turnpike Commission is composed of G. Franklin McSorley, chairman; James F. Torrance, secretary and treasurer; and David E. Watson, with Joseph J. Lawler, Secretary of Highways, as an ex officio member. For directing the engineering and supervision of the Northeastern Extension the commission maintains a field office at Lehighton. The tunnel operations come under the jurisdiction of Harry Lundy, senior division construction engineer. Alden E. Cornell is inspector.

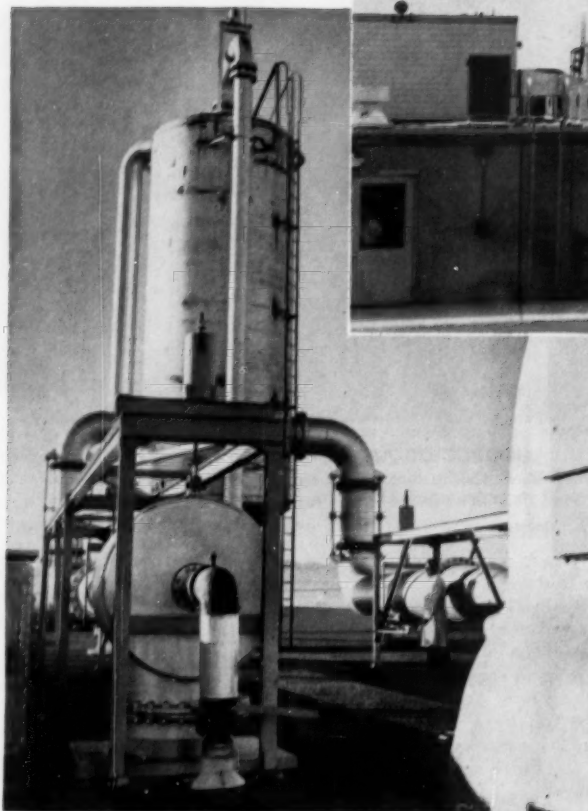
Harold Wambacker is resident engineer for Parsons, Brinckerhoff, Hall & MacDonald and Evar J. Forslund is his assistant.

Joseph Thomas, veteran in the heavy construction field in New York City and Philadelphia, is general superintendent for Lipsett, Inc. Philip Miller is consulting engineer, Michael Carey project engineer and Morris Fishkin general administrator. James Sullivan is superintendent at the north portal and walking bosses are Otto Bender, Ottis Birdsey and George A. Rongyos. Allen Burns is superintendent at the south portal and walking bosses are William Daggs and James Townsend.



DRILLING FOR TRENCH

Two DB-35 drifter drills on a single wagon mounting, assisted by a Jack-hammer at the left, start drilling blastholes in the tunnel floor to excavate a 5-foot-deep trench for the drainage pipe.



GENERAL VIEW AND PRIMARY VACUUM UNITS

Compressed air and vacuum are indispensable utilities for the purpose of simulating flying conditions. In the center of the illustration above are headers from which compressed air at various pressures and temperatures is conveyed to individual test cells. Jutting out of the roof of the building in the background is the upper part of an Ingersoll-Rand barometric condenser, which is shown at close range in the picture at the left together with two I-R steam-jet ejectors that it serves. The jets are the primary source of vacuum. The one at the right provides one-third of the total capacity and the other one (viewed from the end) two-thirds. The condenser has become a landmark and is one of the first things seen by passengers coming into the Phoenix airport.

Testing Aircraft Accessories

New Facilities in Arizona Can Duplicate Wide Range Of Aerial Pressures and Temperatures

R. J. NEMMERS

BECAUSE of the widespread publicity in the nation's magazines and newspapers, most of us are familiar with the gigantic wind tunnels and high-altitude setups by which the U.S. Air Force and aircraft manufacturers test scale-model and even some full-sized airplanes. Less well known are similar facilities designed and used expressly for checking the performances of aircraft components and accessories such as gas-turbine engines, air-turbine motors and starters, pneumatic controls, cabin pressure regulators, refrigerating and heat-transfer systems, etc.

The Garrett Corporation is one of this country's foremost makers of such accessory equipment. Indeed, it is estimated that about 90 percent of the free world's aircraft, both commercial and military, is equipped with some of its products. Last summer the firm completed new testing laboratories adjacent to its AiResearch Manufacturing Company division plant at Phoenix, Ariz. The facilities include more than 75 production test cells and stands. Temperatures ranging from -80° to 1100°F and

altitudes from 1000 feet below sea level to 75,000 feet above can be simulated there to check the equipment manufactured by the division.

Simulating actual flight and altitude conditions calls for large quantities of compressed air and large volumes of space in which the air is at considerably lower pressures than at sea level. Conventionally, air is defined in terms of volume and pressure, but in this case, because lab engineers require more exact information, the air supply available is listed in terms of pounds (weight) of air at a given pressure and temperature, as follows: 670 pounds per minute at 300 psi pressure and at a maximum temperature of 900°F; 15 pounds per minute at 1000 psi and at up to 1000°; and 525 pounds per minute at 3.5 psi and at ambient temperature. All can be supplied at the same time. Heaters

are provided for high-pressure, high-temperature air.

The vacuum system is capable of evacuating test cells, including piping, having a total volume in excess of 10,000 cubic feet and handling 200 pounds of air per minute at a suction pressure of 1 inch of mercury, absolute, corresponding to an altitude of 75,000 feet. (This calls for an evacuating capacity of about 80,000 cfm of air at 1-inch-mercury pressure, absolute.)

Reciprocating compressors are used to provide the high-pressure air, blowers the 3.5 psi air, and steam-jet ejectors and vacuum pumps are brought into play to exhaust and keep the test cells under the required vacuums. The primary-stage steam jets discharge into a barometric condenser, which projects far above the single-story buildings that constitute the test facilities. The tall



structure has become a landmark visible for miles across the flat Phoenix basin.

Two jets, both of Ingersoll-Rand manufacture, are available and are referred to as one-third and two-thirds capacity units. To be more explicit, one is approximately twice as large as the other. The installation was designed in this way to achieve more regulatory steps between no-load and full-load. The jets take suction directly from a vacuum header and use steam at a nominal pressure of 200 psi at the nozzles. Cooling water for the barometric condenser is recirculated through a cooling tower, thus conserving water in the arid climate. The tower is of the forced-draft type

with five fans and also handles coolant for other test equipment.

The two secondary-stage vacuum pumps take suction from the condenser and each is equipped with a line entrainment separator to prevent carry-over of water. They are single-stage duplex units driven by synchronous motors and also are of I-R make. Four Maxim silencers, one on each of the cylinders, help to reduce the noise level, which is unavoidably high because of the large volumes of air handled by the ejectors and vacuum pumps. The cooling system for the latter is of the closed-circuit type—water from the cooling tower, instead of circulating through the pumps, cools them indirectly by lowering the temperature of their jacket water in a heat exchanger.

The test facilities include a giant altitude tank, 15 feet in diameter and 32 feet long, in which equipment can be "lifted" from 1000 feet below sea level to a height of 70,000 feet in just one minute, if necessary. The pressure in the chamber is controlled by the amount of air that is allowed to flow into the tank and vacuum header and also by throttling the air line leading to the header. Inflow is measured across a set of flow orifices interposed in the intake line; outflow is regulated by a motor-operated butterfly valve located in the vacuum line between the cell and the header and by an atmospheric bleed line in the header. By properly manipulating the valves, any desired rate of ascent or descent can be attained. To climb, outflow is set at a rate greater than in-

flow, the magnitude of the difference determining the rate of change. Temperature within the chamber also can be closely controlled.

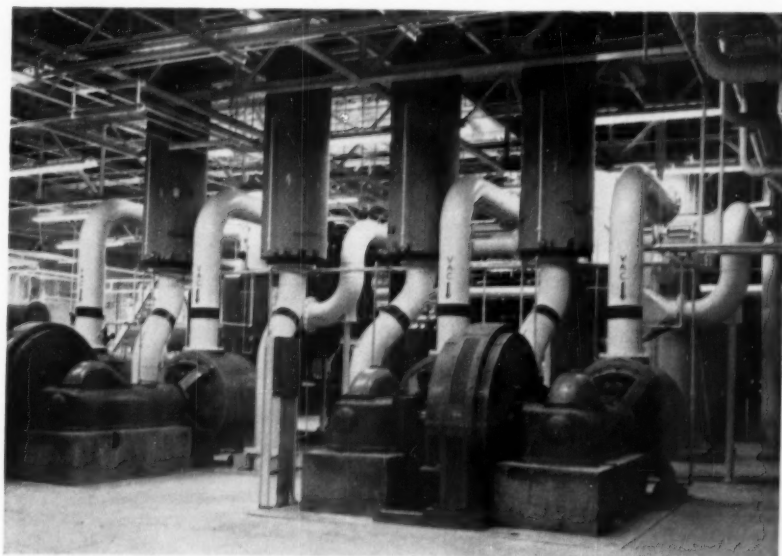
A feature of the laboratory equipment is a refrigerating system with a cooling capacity equivalent to the heat absorption of ice melting at the rate of 100 pounds per minute at -65°F . The reason for the high capacity at that temperature is that the temperature at an altitude of 75,000 feet is about 395°R Rankin, which corresponds to -65°F . But temperatures can also reach high levels, so there is steam jacketing around the tank to simulate high-temperature as well as freezing conditions. To increase the efficiency of the heating and cooling systems in the large chamber, a motor-driven fan recirculates some of the air.

Much of the equipment made by the AiResearch Manufacturing division serves to maintain selected temperature and pressure conditions within the cabin of an aircraft while using the ambient air outside of it. These products are tested in six so-called cabin-atmosphere tanks each of which is divided by a pressure bulkhead into two approximately equal sections that can be regulated independently. Accessory equipment is mounted directly on the bulkhead, just as it would be in an airplane.

The facilities are intended primarily for test purposes, and each production item is subjected to more severe conditions than it would normally encounter in actual flight. For example, air-turbine motors are operated continuously for twenty hours, much longer than usual. From time to time, as quality-control standards dictate, an occasional unit may be set up for a life-endurance test. Furthermore, special research and development projects are continually underway, thus utilizing the extensive laboratory equipment to the fullest.

It should be pointed out that the temperatures and pressures mentioned in this article are those normally required, but both higher and lower ones can be attained under certain limitations for special tests and research work. In addition to the pressure-temperature performance tests, studies are made of the effects of vibration, humidity extremes, fungus growth and salt spray on the equipment. Dynamometer determinations also are obtained.

The AiResearch Manufacturing Company's production test plant is leased from the Air Force and was constructed under contract by Kitchell-Phillips Company. It was designed by the engineering firm of Ralph M. Parsons Company, which also supervised the erection and initial acceptance tests for The Garrett Corporation and the Air Force. A sub-contract for the installation of the heavy equipment was awarded to J. H. Welsh & Son.



SECONDARY VACUUM UNITS

The secondary stage of the vacuum system is provided by two Ingersoll-Rand single-stage, duplex Type XRE vacuum pumps which take suction from the barometric condenser. Driven by synchronous motors, the units exhaust to atmosphere through four Maxim silencers (the vertical cylinders). Behind the latter are line-entrainment separators that prevent water from the condenser carrying over into the vacuum cylinders.

PUTTING UP 20-INCH VENTILATION PIPE

The Naylor ventilation pipe is suspended from the roof by chains attached to rock bolts. It comes in 20-foot lengths weighing 400 pounds each. Sections are placed by two men, as shown below. The pipe, which was transported from the shaft station on a Hydra-Boom drill carriage, has been rolled over into a cradle at the end of a piece of 2-inch pipe inserted in the saddle arm supporting the drifter drill at the left. Steadied and balanced by the man in the foreground, it is being raised into position by the boom so it can be joined to the end of the line seen at the upper-left. The picture at the right shows a stretch of 9x9-foot drift with the ventilation pipe in place. Below it, along the wall, are a 3-inch compressed air line, a 2-inch drill-water line, and an electrical cable that furnishes current for blasting.



DEEP BREATHING

Miners Toiling Below Sea
Level in Idaho Inhale
Mountain Air that Travels
2½ Miles into Workings

E. B. OLDS *



SECTION THROUGH CRESCENT MINE

Air breathed by miners advancing the heading at the bottom-left is drawn in 4000 feet from the outside through the Hooper Tunnel level and sent underground through 9000 feet of pipe line by the Motorblower shown in the picture below. In all, it travels about 2½ miles and maintains comfortable working conditions on the lowest levels despite a rock temperature of 88°F.

THE Coeur d'Alene mountain range in northwestern Idaho is a leading source of metals, especially silver, lead, zinc and copper. The exploration and development of deep-lying ore de-

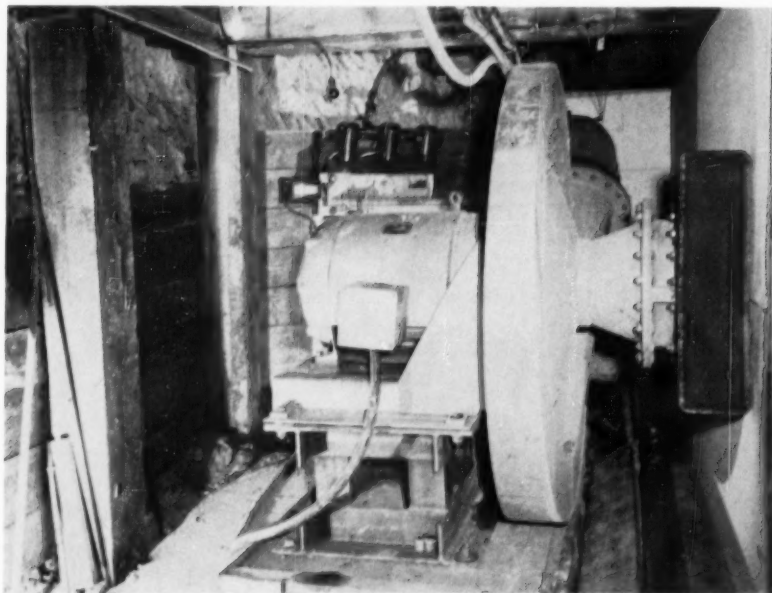
posits in this upland region call for the driving of long tunnels or adits and the installation underground of hoists capable of lifting ore more than 3000 feet vertically.

Ventilating such extensive workings is sometimes a difficult problem. Picture, for instance, bringing a supply of fresh air into a mountain through 4000 feet of tunnel, then sending it down a 3200-foot shaft where the temperature rises about one degree for every 100 feet of descent, and finally moving it an additional distance of several thousand feet to a working face.

That, in brief, is what is being done at Bunker Hill Company's Crescent Mine 7 miles east of Kellogg in Shoshone County. The adit-level (Hooper Tunnel) portal and surface buildings are located on the western slope of Big Creek Canyon. The collar of the Crescent Shaft is 4000 feet west of the portal on the tunnel level at Elevation 2709. Deepening of the shaft from the 1275-foot level was started on June 24, 1953. Eleven months later—on May 27, 1954, to be exact—2000.5 feet of new shaft had been completed and a station cut on the 3200 level, which is 400 feet below sea level. Since then some 8000 feet of drifts and crosscuts have been driven on the 3200 level.

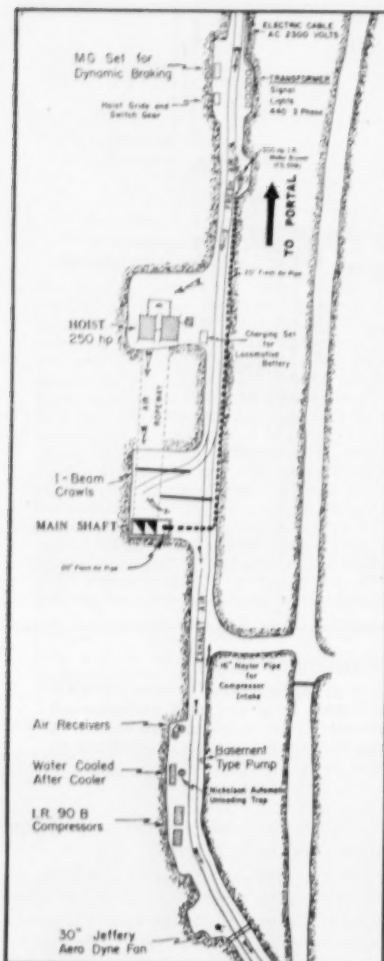
A 30-inch-diameter Jeffery Aerodyne fan powered by a 50-hp motor is located west of the shaft collar and delivers 28,000 cfm of air, incast, to the main adit level. The air is exhausted through old workings on the No. 4 adit level which is 565 feet above the Hooper Tunnel level.

*Superintendent, Crescent Mine



MOTORBLOWER

This Ingersoll-Rand single-stage Motorblower compresses 9300 cfm of air from atmospheric pressure to 3.75 psi and delivers it underground as indicated in the sketch above. The screened rectangular opening at the right is the intake.



UNDERGROUND EQUIPMENT

Plan drawing of the Hooper Tunnel level in the main-shaft area, showing the great amount of equipment that is required to conduct mining operations. Space for the various units had to be excavated from solid rock.

During the sinking operations the shaft was ventilated by two Coppus 25-hp blowers. One unit was mounted in the manway compartment at a point 60 feet above the shaft collar and supplied about 6000 cfm of air, which was directed through 20-inch Naylor Spiralweld pipe to the 3200 station. The other blower was at collar level and served, by means of regulating dampers, to exhaust approximately 5300 cfm of air from that station.

The rock temperature 400 feet below sea level in the Crescent Mine is 88°F. A minimum of 9000 feet of crosscutting and drifting was planned at that horizon and a 20-inch-diameter pipe was the largest that could be used to carry the necessary ventilating air. In order to provide the headings with fresh air and maintain an atmosphere conducive to efficient working at that depth a 200-hp

Ingersoll-Rand, Model FS, single-stage Motorblower was placed on the main tunnel level about 200 feet from the collar of the shaft. This machine seems to solve the ventilation problem better than any other equipment so far tried in the Coeur d'Alene District.

The blower has a rated capacity of 9300 cfm at 3.75 psi or 104 inches of water pressure. The "blast gate" or fan-intake damper is adjusted so that the 2300-volt motor draws 46 amperes of current. An ampere meter was permanently installed with the fan. The blast gate is padlocked at the proper setting to prevent tampering, which could easily overload the fan and burn out the motor.

The Motorblower furnished ample air to ventilate two headings as they were advanced on the 3200 level. The air was taken down the shaft in a 20-inch pipe which branched on the working level into a 15- and a 20-inch line. Operations in the northwest heading served by the 15-inch pipe were suspended after it had been driven 2000 feet. The southwest heading is still being advanced and is about 6000 feet from the shaft station. It is now being ventilated by the entire output of the blower delivered through the 20-inch line. Following is a summary of the conditions that recently prevailed in that heading:

Underground travel of ventilating air	13,000 feet
Travel through 20-inch pipe	9,000 feet
Volume of air delivered to heading	9,300 cfm
Air temperatures: dry bulb	73°F
wet bulb	64°F
Rock temperature	88°F

Despite the high rock temperature, the volume and temperature of the air provide excellent working conditions.

Twenty-foot lengths of the Spiralweld ventilating pipe are the longest that can be handled at the shaft stations. As they weigh 400 pounds each and must be suspended from the roof, they represented both a haulage and an installation problem. That was solved by using an Ingersoll-Rand Hydra-Boom drilling jumbo that runs on the mine rails. A section of pipe is loaded on the carriage at the shaft station with the aid of an electric chain hoist and, riding between the two booms and drifter drills, transported to the heading. There a 20-inch length of 2-inch pipe with a "cradle" welded to its outer end is inserted in the saddle arm supporting one of the drills. The ventilation pipe is rolled into this cradle, being balanced at about its midpoint and steadied by a man at one end. It is then hoisted into position with the hydraulic boom and suspended by a 1/4-inch chain attached to a rock bolt in the roof.



MINE HAULAGE LOCOMOTIVE

Five-ton battery locomotive at an underground switch. Overhead are the ever-present lines that supply air, water and electricity.



COLISEUM NEARING COMPLETION

This picture, taken in October 1955, indicates the vastness of the lower-floor space provided by the structure, which has a basal area of 421x325 feet. Fronting on Columbus Circle, it extends from 58th to 60th Street and is readily accessible by subways and buses. In the foreground are field offices of the architects and various contractors, grouped to expedite construction. Built of prefabricated wood panels on a bridge over the sidewalk, they were 360 feet long.

Gotham Seeks More Trade Shows

New \$35-million Coliseum provides 300,000 square feet of exhibition space plus office building and parking

IN AN effort to lure more conventions, trade shows and exhibitions, New York City has just completed a \$35-million Coliseum. Fronting on Columbus Circle in the heart of Manhattan Borough, it was constructed by the Triborough Bridge and Tunnel Authority and will be operated by the Coliseum Exhibition Corporation. It will be the largest facility of its kind, with 300,000 square feet of exhibition space located on four floors. All of it or any section of it may be utilized at one time. For example, four shows, each accommodated on one floor, can be handled simultaneously.

To provide a central location for the structure, the City of New York condemned the properties on two blocks and closed the street between them to form one plot. The buildings on the site were razed, including a 27-story office structure, a theater, and some 6-story tenements. Fifty-one percent of the ground was turned over to private builders for the erection of apartments and the remainder was set aside for the Coliseum.

The latter structure is actually three in one. To meet the need for a parking place there are two floors below street level with room for 850 cars. The exhibition area covers most of the next four floors. Towering over them on a part of the site to a height of 310 feet above street level is an office building with

540,000 square feet of rental space. This feature of the project was added to increase the revenue sufficiently to make the venture self-supporting. It is expected that the exposition space will lose money, the garage will break even and the office building will return a modest profit.

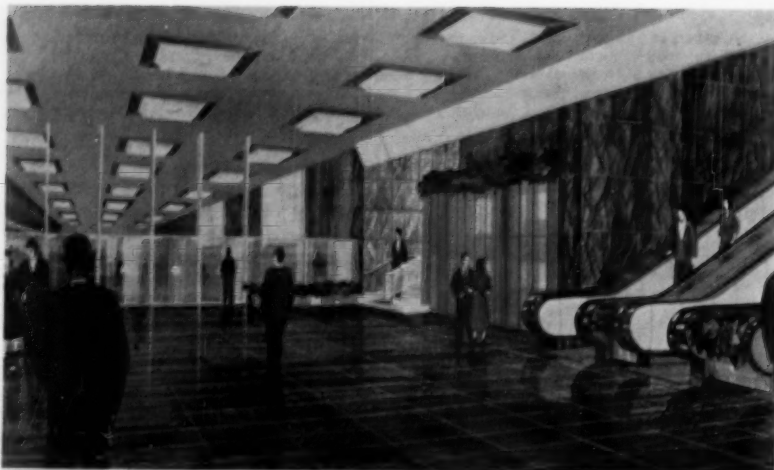
It was never the intention to make money on the Coliseum itself, but rather to use it as a magnet to attract more shows and conventions. In 1954, with admittedly inferior facilities, New York drew 749 such gatherings, and it is estimated that visitors attending them spent \$200 million for meals, lodging, entertainment and merchandise. Promoters of the Coliseum expressed the need for it as "desperate."

The building was erected with unusual speed, less than two years having elapsed from the time site clearance was begun until the first trade show was opened late last month. After the existing structures had been leveled, it was necessary to excavate 150,000 cubic yards, about half of it rock. With only part of that work completed and drilling and blast-



CUTAWAY VIEW

The full area of the first four floors is for exhibition purposes, with offices in the tower starting on the fifth floor. A square well, 150x160 feet, extends through the upper three floors at the right. The Coliseum was officially opened on April 28, with three shows running simultaneously. They were the National Photographic Show, the International Automobile Show and the Fifth International Philatelic Exposition.



CONVERTIBLE LOBBY

The lobby is 250 feet long and 70 feet wide. It can be used as one giant foyer, or be divided by glass doors into four separate spaces each serving one show. Walls are of Catalan red and St. Michel gray, veined marble; floors of Venetian terrazzo.

ing proceeding, steel erection was started, but not nearer than 100 feet to the shots. Construction from preliminary plans was begun and continued while final ones were being prepared. Eight hundred individual drawings and 60,000 blueprints were required. The general contractor was Walsh-Fuller-Slattery, a joint venture of Walsh Construction Company, George A. Fuller Company, and Slattery Contracting Company, all of New York. Approximately 75 subcontractors also had a hand in the work.

Because of the special purpose for which the building is designed, its planners made an extensive preliminary study of the needs of various shows and conventions throughout the country. As a result, the structure includes provisions to meet those requirements. For example, exhibitors will have easy access to compressed air, water, electricity, gas, steam and telephone lines, as well as wiring for television and radio sets. Electrical outlets installed in the floors are on 30-foot centers, which means that every point is within 15 feet of one of them. This is a permanent network, whereas other utility lines will be laid in underfloor channels as the need for them arises. These raceways, as they are known, have covers on them that can be readily removed.

Compressed air at 80-100 psi pressure will be supplied by a 100-cfm machine in the basement and will be delivered to the exhibition floors above by pipe lines enclosed in fourteen supporting columns. Take-offs from the latter will be laid in the raceways as required. In addition to the pressure lines there will be exhaust lines to carry away dust and other finely divided material caused by grinding wheels and similar appliances that may be used by exhibitors. All these suction lines will lead to a 5-inch

pipe discharging to atmosphere above the roof.

It is estimated that the facilities for handling freight will reduce the usual cost of setting up shows by 50 percent. Trucks, instead of being unloaded on the street, will drive in. Anything that can travel the highways can enter the Coliseum. A ramp wide enough for two trucks to pass each other leads to the second floor. Five freight elevators are provided, and one of them is long enough (49 feet) to accommodate the largest truck-and-trailer combination on the road and can lift 37½ tons. Live-load limits are sufficiently high to permit heavily laden vehicles to drive on any of the exhibition floors, which are made of stone chips and concrete, polished to make a good appearance but durable and easily kept clean.

The 70x250-foot lobby of the building can be utilized in its entirety when all floors are given over to one exhibition. When there are multiple smaller shows it can be divided by glass partitions into individual foyers for the respective floors. Nine passenger elevators will carry 200 persons at a time, and seven reversible escalators can handle 40,000 an hour. The second-floor exhibition hall, with 82,517 square feet of floor space, can be converted into an auditorium or theater with temporary seats for 10,000 people. A 30x90-foot area at one side is recessed for use as a stage with adjacent dressing rooms. Besides a general cafeteria accommodating 400, there are three food counters and a bar on each floor. All public places, including the offices, will be air conditioned by means of a 4050-ton refrigeration plant. The cooling tower that will serve it is stationed on the roof of the exhibition section.

The construction of the Coliseum is recognition by New York City that trade

shows and conventions are big business and will most likely become bigger. In one form or another, it is claimed, they have been held for 5000 years. The earliest ones were religious festivals, but merchants and artisans soon took advantage of the opportunity they offered them to display their wares. Through the Middle Ages they took the form of fairs and carnivals. Specialized trade shows appeared at the time of the industrial revolution.

Most participating companies consider modern expositions worth while. They give them a chance to talk with customers from near and far within a short time. Some large concerns are entering twice as many shows now as they did only a few years ago. One source reports that 200 were held in the United States in 1910 and 3000 in 1955. Today, they represent an annual expenditure estimated at \$2.5 billion.

The Coliseum Exhibition Corporation has a 10-year lease on the building and an option to renew it for a like period. It will pay the Triborough Bridge and Tunnel Authority \$300,000 a year rental, plus a graduated percentage of the gross income. The city retains ownership of the site and will receive from the Authority \$2,182,230 (\$15 per square foot) annually for its use. The Authority will also pay the city a minimum of \$42,000 in lieu of taxes.

High-Vacuum Brazing

NOW that vacuum furnaces for melting metals have reached the practical stage, along comes vacuum brazing. Pratt & Whitney is using the method to join jet-engine parts and assemblies. The equipment, built by F.J. Stokes Machine Company, Philadelphia, Pa., consists of a furnace base and of two bell-shaped covers: an inner one which forms the vacuum chamber and a larger outer one which contains heating coils. When lowered over the base, water-cooled O-rings form an airtight seal. The bells move up and down on guideposts.

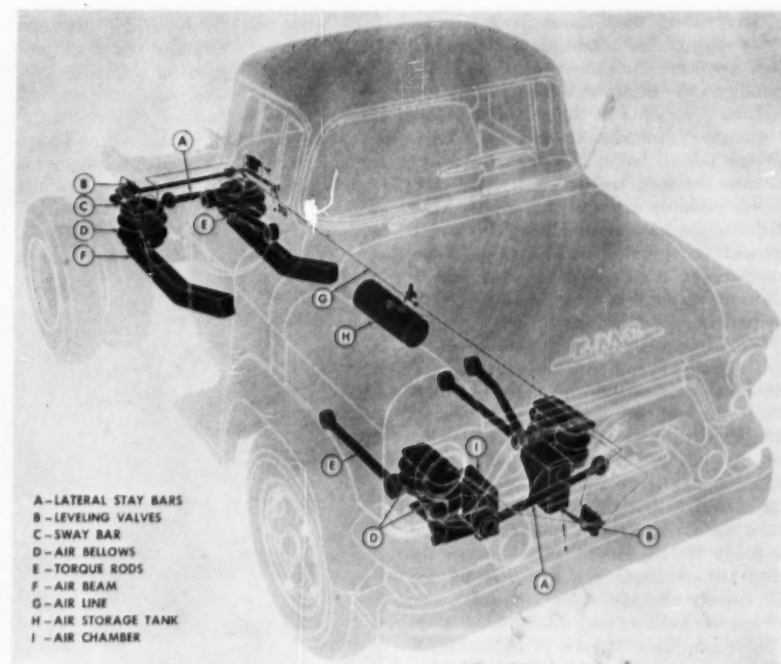
The work, with the required amount of brazing wire wrapped around it, is mounted in a fixture that fits on the base, which is connected with a booster and vacuum pumps. Both the annular space between the covers and the brazing chamber are evacuated. At a temperature of 2150°F the wire melts and infuses the parts, binding them together. It takes a day and a half to complete the operating cycle, or about the same length of time as when a hydrogen or other special atmosphere is used. However, according to the furnace manufacturer, a high vacuum free from oxidizing gases produces better results at lower cost. The National Advisory Council on Aeronautics goes even farther and reports that vacuum brazing is 50 percent superior to dry-hydrogen brazing.

Air Springs for GMC Trucks

FOLLOWING three years and 400 million miles of successful experience with air springs on its passenger buses, the Truck & Coach Division of General Motors Corporation is incorporating them in its trucks. The prototype of models to go into regular production later in the year is now being tested in cross-country travel and shown to truckers in different sections of the United States. The vehicle is a tractor with a semitrailer.

Rubberized bellows apparently have several advantages over the conventional leaf-type metal springs that have long been used. For one thing, the cargo gets a far gentler ride on air than on steel. That was demonstrated by carrying some fragile articles 6000 miles from Pontiac, Mich., to Miami, Fla., and thence to Los Angeles and San Francisco in the test truck. Included in the shipment were glass automobile windshields, Christmas-tree ornaments and 5-pound cans of pretzels. They survived the long trip substantially undamaged.

The ornaments originated in Germany and traveled 5204 miles by boat and rail to reach Michigan. On that journey three dozen out of 60 dozen—an even 5 percent—were broken. In contrast, the remaining 57 dozen made the cross-country haul without breakage. They and the other products were packed in lightweight, inexpensive cartons. The pretzel test is considered especially indicative of a “soft” ride because these tidbits are termed the nemesis of food handlers. When the truck reached Los Angeles, furniture, china- and glassware were added and withstood the final 500-



PHANTOM DRAWING SHOWING COMPONENTS

Air-filled rubberized bellows replace conventional leaf springs and the vehicle literally rides on air. Air metered into the bellows by leveling valves keeps floor height at a constant level and absorbs road jolts and vibrations.

mile leg of the trip unscathed. Reduction of cargo breakage is of paramount importance to the trucking industry. According to Interstate Commerce Commission statistics, cargo loss or damage was equal to 53.5 percent of the net operating revenue of 1100 Class I carriers of property in 1953. Even a 10 percent decrease would be a major accomplishment.

The protection afforded cargoes by air suspension should not only cut down breakage to a minimum but also permit

lighter-weight, less-expensive packaging of goods, says Philip J. Monaghan, general manager of the Truck & Coach Division. Its statisticians estimate that the division itself would save around \$200,000 annually in labor and packaging materials alone if its truck replacement parts were shipped in such containers.

Lubrication, repair and replacement of metal springs are major maintenance items. Bellows require no lubrication and little upkeep and, in addition, allow a reduction in truck weight of approximately 450 pounds. This saving, plus that realized by lightweight packaging, would make it possible to increase the payload proportionately. Furthermore, space previously needed for metal-spring deflection could be given over to cargo in the air-suspension unit because the floor level always remains at the same height. This permits the fifth wheel on the tractor to be lowered sufficiently to add about 100 cubic feet to the trailer body.

The air spring consists of a bellows connected to an air chamber and receives its air supply from the compressor that serves the vehicle's air-brake system. A leveling valve automatically meters the air from the chamber into the bellows, thereby compensating for a light or a heavy load. When the spring is depressed by reason of the wheel passing over a rough spot, air is forced from it into the chamber. Rebound is snubbed



TRACTOR-TRAILER USED ON CROSS-COUNTRY TRIP

by the valve, thus minimizing shock.

Air springs are reported to be much more sensitive than metal ones. Air responds to the slightest vibration, giving maximum benefits in the range of high-frequency vibrations where metal leaf springs fail to begin flexing because of friction between the leaves. Also, air makes possible a truly progressive rate of deflection because the more it is compressed the greater its resistance. In comparison, a metal leaf spring has a uniform rate of resistance throughout its period of deflection.

While a trailer is at a loading dock and detached from the tractor a set of steel blocks is swung into place between the frame and body and the air is vented from the system so that the body settles on the blocks, keeping it level while being loaded or unloaded. When again connected to the tractor, air is pumped back into the system and the vehicle is ready for the road. This is the only time the compressor is required, as the air merely shuttles back and forth between the bellows and the air chambers.

It is said that there is little likelihood of bellows failing or developing leaks. In more than 300 million miles of coach travel on the Greyhound line, breakdowns have averaged one in a million miles. When an air spring collapses, the truck frame comes to rest on hard-rubber blocks and the vehicle can still be driven, but at low speed. A bellows can be replaced by a mechanic in 30 minutes, and the only tool needed is a 1/2-inch wrench.

When the test tractor-trailer reached San Francisco, trucking-company officials were given rides in it so that they themselves might judge the merits of air springs. As they sat in seats arranged for their comfort, a closed-circuit television hookup enabled them to observe the action of the bellows underneath as they ironed out jolts imposed by uneven road surfaces. Before the truck made its long trip, it was tested extensively on the Belgian block "torture" course at General Motors' proving ground in Milford, Mich. After 5000 miles of operation there it showed no serious signs of wear and tear, although trucks equipped with metal springs normally develop body damage in less than 500 miles.

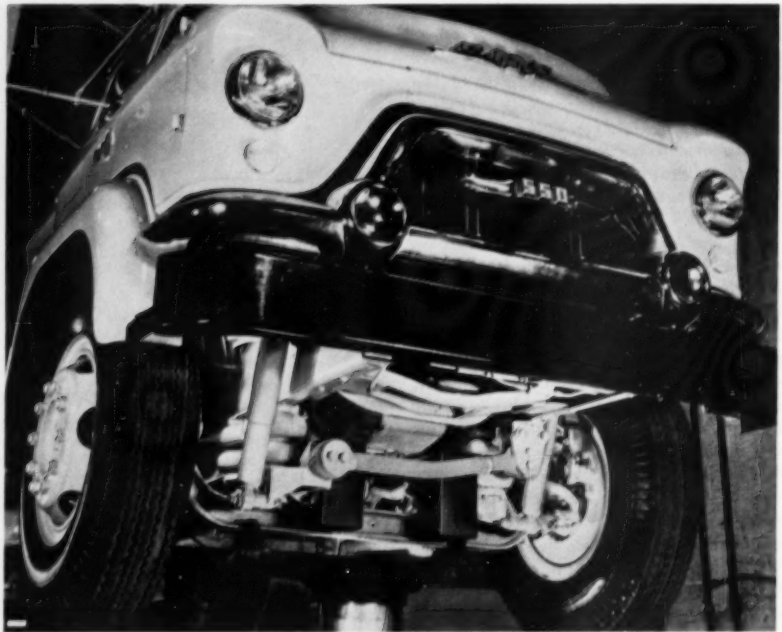
According to Monaghan, the new springs will be offered first on highway tractors in the 50,000- to 65,000-pound gross-cargo weight class because they have the greatest need for the advantages of air suspension. Although their first cost will exceed that of metal-spring models, it is the belief that they will be economically attractive once full consideration is given to the resultant benefits. He punctuated this prediction with the statement that all GMC coaches are now sold with air suspension.

The idea of using air springs to cushion

shock is not new. In 1946 The Firestone Tire & Rubber Company and Pullman-Standard Manufacturing Company collaborated in testing doughnut-shaped units on railway cars. But even before that time something of the sort had been applied in a limited way to buses, truck trailers, airplane landing gear and Bofors anti-aircraft gun carriers. Developmental work continued, and in 1953 General Motors put bellows on its new buses.

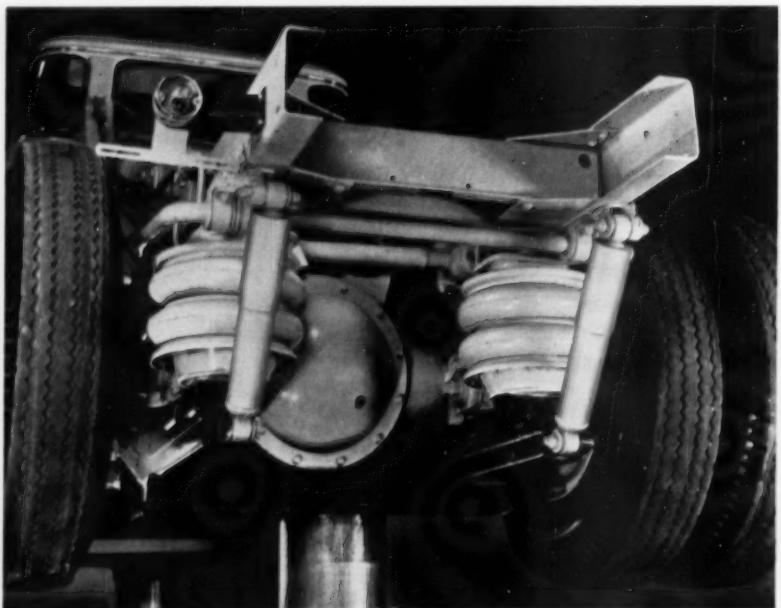
More recently they have been embodied in some of the lightweight trains now being tested on various railroads.

In an address to the American Chemical Society last month, D. E. Harpfer, assistant manager of industrial products development of the Goodyear Tire & Rubber Company, predicted that "the passenger automobile of tomorrow will ride more comfortably on rubber air springs."



FRONT AND REAR VIEWS

Bellows and air beams on the axles of the tractor. Air travels back and forth between these members and a chamber and none of it is lost.





Tecolote Tunnel Now in Service

THE Tecolote Tunnel on the Pacific Coast—one of the most troublesome holes ever bored through rock—is finally in service, but some construction men will long remember it. Starting out as a \$4½ million job, it cost close to \$10 million and left its mark on all who worked on it. All told, it took nearly six years to complete, including an 11-month shutdown in 1953 to enable engineers to study the situation with a view to changing their strategy. At that time the original contractor, Halvorson Constructors, subcontracted the remainder of the work to Coker Construction Company and Peter Kiewit Sons Company, which finished it.

The Tecolote, a 6.4-mile tunnel through the Santa Ynez mountain range in California, is a part of the Bureau of Reclamation's Cachuma Project which is designed to impound water by damming the Santa Ynez and to convey it through the bore for delivery to the City of Santa Barbara and 27,000 acres of nearby agricultural land. During tunnel driving, up to 7800 gpm of sulphurous water at temperatures reaching a maximum of 117°F was encountered, and the workings were so hot that the crews sought relief by riding into the bore in muck cars filled with cool water.

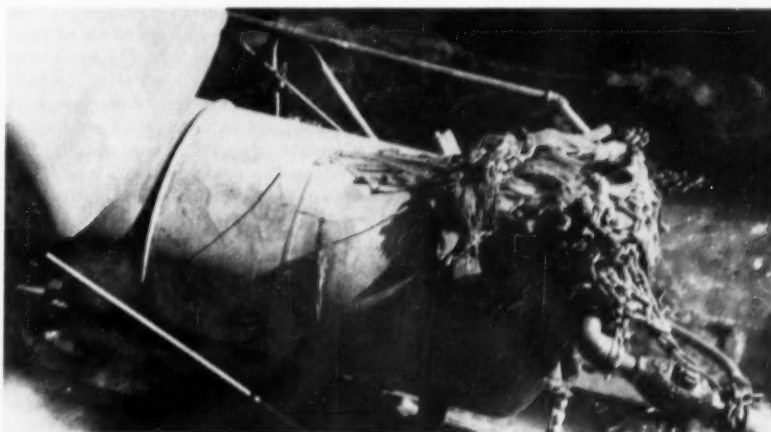
The joint contractors completed lining the 6-foot-diameter tunnel in January of this year and were then asked by the Bureau of Reclamation to drill through the concrete directly overhead a series of 2-inch holes 50 feet apart from portal to portal. These were intended to drain off water from above to relieve pressure and were provided in addition to weep holes previously placed in the lining 2 feet above the invert.

As the contractors had by that time removed their air line from the bore, and restringing it would have been both time-consuming and expensive, this sup-



MISSION COMPLETED

Frank Wiebel, master mechanic (top), surveys compressor in rushing hot water outside portal. Stoper drill (center) hangs on front end. Machine's oil separator-receiver was rearranged (bottom) to fit into narrow bore.

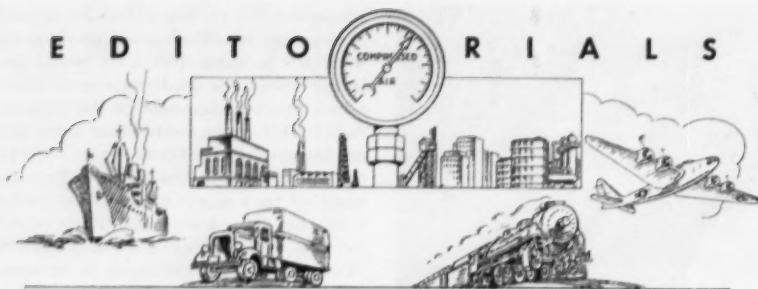


plemental job clearly called for a portable compressor that could travel along with the stoping drill that would put in the holes. The small opening wouldn't admit every compressor of the capacity called for, but the contractors knew that an Ingersoll-Rand Gyro-Flo of 315-cfm capacity would fit the space and sought one that they might rent for the limited time they would need it. Their search led to a unit that came to be known as "Old 182"—the final digits in its serial number.

The compressor was rented from the Golden State Equipment Company in Los Angeles. It was originally sold to C. F. Braun & Company, of Alhambra, which used it for four years on oil-refinery construction jobs before disposing of it as depreciated equipment. In order to make the machine fit into the tunnel, the contractors mounted it on a special low-wheel dolly and changed the position of its separator-air receiver.

While drilling was in progress there was a considerable flow of water, which entered through the weep holes. Its temperature was around 100°F. The compressor muffler was removed and the engine exhaust piped into the water. The men worked on the upstream side of the unit and a fan at that portal blew air past them and then past the compressor. Thus they were not exposed to the exhaust fumes. Despite the heat and corrosive vapors rising from the water, "Old 182" did its stint without incident or complaint, and an engineer who happened on the scene as the final holes were being put in reported that it was "running like a well-oiled watch." William Roberts was job superintendent.

When the Cachuma Project began to operate on March 1, its reservoir contained 900 acre-feet more water than was necessary to feed the Tecolote Tunnel. It is estimated that this volume, supplemented by flows from the stream into the impounding basin and those entering the tunnel from within the mountain, will suffice during the coming year to supply the Santa Barbara area.



HE SHOWED THE WAY

DEATH recently ended the career of Daniel C. Jackling, one of the Titans of the mining world. At a time when the discarded mill tailings of some mines contained 2 percent or more of copper, he contended that money could be made by producing ore of that grade in large quantities. It took years for him to get financial backing to prove that that was so. But eventually he did, and that was the beginning of the now famous Bingham Canyon open pit in Utah—the forerunner of numerous other lean-ore mining enterprises.

Orphaned at the age of two, Jackling was raised by relatives on a Missouri farm. He first became a teacher, then entered the Missouri School of Mines where he completed the usual 4-year course in three. At the time of his graduation the gold-mining camp of Cripple Creek, Colo., was booming, and he went there, walking the final 18 miles because he lacked full stage fare. There he met Charles McNeill and Spencer Penrose who were later to join him in his revolutionary copper-mining scheme.

Leaving Cripple Creek after a few months, Jackling became construction and metallurgical superintendent at the Golden Gate mill at Mercur, Utah, owned by a Capt. Joseph De Lamar who also held an option on most of the claims in the Bingham Canyon area. Jackling and another member of the technical staff, Robert Gemmel, were sent there to make an examination. Their report recommended that the operation be exercised and proposed mass mining and milling. But the captain thought the deposit was too low grade to pay and let the option drop.

That was in 1898. Jackling went on working at various mining properties, but never stopped trying to interest capital in his low-grade production idea. In 1901 he returned to Colorado as consulting engineer for a company headed by Penrose and McNeill and finally induced them to inspect the mountain of lean ore in Utah which, Jackling estimated, contained at least twelve million tons of material of 2 percent grade. The Colorado pair agreed to finance the "dream," but before operations could be started more money had to be raised, and that proved to be difficult. Finally,

Daniel Guggenheim and associates spent \$150,000 investigating the property and then went on to finance a 6000-ton mill. That was the start of the highly successful Utah Copper Company.

Jackling later devised a process for upgrading lean iron ores in the Mesabi Range in Minnesota and eventually headed or helped to run a dozen or more important mining companies. Technical societies awarded him medals, colleges gave him honorary degrees and during World War I he compiled an outstanding record as director of government explosives manufacturing plants. In 1954, in recognition of his contributions to the mining industry of Utah, a 9-foot bronze statue of him was placed in the rotunda of the capitol in Salt Lake City. Its copper content came from Bingham Canyon. Jackling resigned most of his connections in 1942 and lived quietly in San Francisco until his death.

TRAFFIC JAM ON OHIO

NOT all the traffic congestion is on land. The Ohio River, one of our busiest waterways, is finding it hard to meet the demands imposed upon it and is fairly crying out for improvements of its facilities. They must and will come because the Ohio is the marine highway on which flows the commerce of the world's mightiest industrial area. Within the confines of the 200,000 square miles drained by the stream and its tributaries are such cities as Pittsburgh, Cincinnati, Louisville, Columbus, Indianapolis, Terre Haute, Nashville and Chattanooga. The watershed includes all or parts of fourteen states. Europe's highly publicized Ruhr, to which the Ohio Valley has been likened, is a pigmy by comparison with only one-third as much steel production and one-third as much coal output.

Within the past ten years alone, upwards of 2500 new industrial plants have been erected in the Ohio Valley at an aggregate cost exceeding \$10 billion. Meanwhile, river-borne freight has jumped from 36 million tons annually to a high of 62 million. Coal and coke are the leading commodities carried, with crude oil and gasoline, iron and steel next. These are the basic materials on which the area's highly diversified manufacturing strength is founded. Chemical

and metallurgical establishments are numerous. The valley gives us a large proportion of our aluminum and is the seat of several of the government's largest atomic-energy plants.

Nature did not make the Ohio a navigable stream—man had to do that. Although the river pours an average of 158,000 cubic feet of water per second into the Mississippi at Cairo, Ill., a volume that is exceeded only by the Missouri, it originally had many shallow stretches. In the 986 miles from Pittsburgh to Cairo it falls about 500 feet, but there are some rather abrupt drops. The biggest one—23 feet in $2\frac{1}{4}$ miles—is at Louisville.

For two and one-half centuries after its discovery, the Ohio carried little commerce except during the annual spring rise. The first federal appropriation for the removal of snags and other obstacles from its channel came in 1824, and six years later a canal was built around the falls at Louisville. Several years more elapsed, however, before a boat drawing as much as 2 feet of water could thread its way from Pittsburgh to the Mississippi. Meanwhile two canals were being excavated to connect Lake Erie with the river. One of them was opened in 1832 and the other in 1845 and both were used until destroyed by floods.

The construction program that gave the Ohio its present minimum channel depth of 9 feet was carried out by U. S. Army Engineers between 1910 and 1929. It included 46 dams and locks. By the time the work was completed the waterway was inadequate—could not take care of the traffic that had developed. Its shortcomings are now accentuated by the changed method of handling river craft. Today's diesel-powered towboats are capable of pushing up to twenty barges laden with 20,000 tons of freight. A tow is often twice as long as the 600-foot locks through which it must pass, and this requires breaking it up time and again on a long trip. Forty-one of the dams are of the movable type that can be raised during low-water periods to maintain the 9-foot channel depth. Their operating mechanisms are getting old and sometimes fail to function as promptly as they should so that tows are delayed.

A plan to increase the channel depth to 12 feet has been formulated by the Army Engineers. It calls for reducing the number of dams to 21 high-lift structures, each equipped with a 1200- and a 600-foot lock. The work would be spread out over twenty years, and the estimated cost of the program is \$882 million. So far Congress has appropriated \$16 million with which to start operations on three of the locks that are needed most. The floods of last year temporarily diverted attention from the Ohio to the need for dams on numerous other streams.

This and That

Tunnel Patrol Cars

Since the opening of the Holland Vehicular Tunnel between New Jersey and New York, uniformed policemen have walked the narrow elevated ledges alongside the roadway day and night. They see that drivers observe the regulations and also give help in case of accidents or trouble. In January 1955 a patrol car began to cover a 2200-foot "beat" in one of the tubes on a trial basis. It worked out well, and the Port of New York Authority has now ordered four of the vehicles for the eastbound tube. When they are in service, four officers instead of the six now required will be able to police the 1½-mile stretch. If the further trial is successful, it is expected that cars will be installed in the westbound Holland tube and the three tubes of the Lincoln Tunnel at an estimated cost of \$1,000,000. The test car is 2 feet wide, 11 feet long and 6 feet high and weighs 1300 pounds. It has a reversible seat and moves in either direction at 6 to 15 miles an hour. It is driven by two electric motors.

* * *

Robot Weather Station

A prototype marine weather station that automatically reports local weather data by radio has been developed by the National Bureau of Standards. It is incorporated in a buoy that can be anchored in remote locations and left unattended for periods of up to six months. At regular intervals throughout the day the station broadcasts in code the air temperature, water temperature, barometric pressure and wind speed and direction. Preliminary tests in Chesapeake Bay show that it has a radio range in excess of 800 miles.

The station translates information from each of five weather sensing elements into 3-letter groups in Continental code and sends the coded signals. They can be received on standard communications receivers and compared with a decoding table that gives numerical values for each of the meteorological variables measured. A single transmission takes three minutes.

The vessel that carries the equipment is 20 feet long and 10 feet wide. Constructed of aluminum and other non-magnetic metals to avoid undesirable effects on the compass, it can be anchored in water as deep as 3600 feet. Two masts and four water-tight wells extending below the boat deck hold all the electronic and meteorological instruments in shock-mounted units.

Gathering comprehensive weather data from many ocean areas outside of the regular shipping lanes is now hap-

azard and limited. Both military and civilian authorities would be better able to predict weather conditions if they received continuous weather reports from a much wider area. If a series of stations similar to the one described were to be dotted over wide areas of the Pacific, for example, they could make possible a complete weather picture of the entire sea. If moored in certain sections of the Caribbean they might also give warning of hurricanes as they form.

* * *

Tower Is Spray Painted

The spray method isn't normally considered efficient for painting slender steel towers, which are mostly open air. However, it proved to be the only acceptable method in the case of a 550-foot radio tower at Station KWK in St. Louis. When Stanley Hanks painted it in 1949, his men used brushes and he was deluged with claims by people who said their automobiles were spattered while parked or passing below. This year, he accepted the job again rather reluctantly, but decided to change the technique. First, having determined that some new ultrafast drying paints could be applied by spray gun, he decided on that method. Next, he sent his men to a school conducted by the DeVilbiss Company where they learned how to keep overspray down to a minimum. The combination solved the problem. Although the tower rises at the edge of a busy downtown area and no effort was made to prevent cars from parking there, not a single claim for damage was received. The work was completed in six weeks by five men, working off and on when weather conditions were favorable. Only two spray guns were used, three men being occupied with cleaning and rigging.

* * *

Novel Spillway Design

An auxiliary spillway of unusual design has been incorporated in the Alamogordo Dam in New Mexico to increase its capacity for discharging surplus reservoir water. Investigations by U. S. Bureau of Reclamation engineers during the past few years indicated that the existing spillway would not handle possible peak floods. To protect the dam from damage by breaching or overflowing and to safeguard downstream residents and property, it was decided to increase the spillway facilities. Enlargement of the existing structure would have cost \$1,526,000, it was estimated, but one-third of this was saved by excavating an auxiliary

spillway in the rock of the left abutment. An earth "fuse plug" was deposited in it after it was completed. Under normal conditions the main spillway will handle the overflow. If a major flood should be experienced, the water would rise enough to wash away the earth plug and open the outlet. Water would then flow through it without endangering the remainder of the dam.

* * *

Lampreys Generate Electricity

The lampreys that have been killing lake trout and whitefish in the Great Lakes are living electric generating stations, according to Dr. H. Kleerekoper, who is supervising a research project at McMaster University in Canada for the Fisheries Research Board of Canada. The parasite lamprey sets up around its head an electric field that has been used, when amplified, to light a flash bulb and trigger the shutter of a camera, thus taking the creature's photograph. It is not known which organs generate the current, but the function is closely synchronized with the animal's breathing movements. The process is different from that responsible for the electric charges produced by the so-called electric eel. The latter is not found in Canadian fresh waters.

* * *

Glass Utility Poles

Tomorrow's utility poles may be built like the new Fiberglas fishing rods. Gar Wood Industries has made some of them in Michigan on an experimental basis and they are now undergoing test by the Consumers Power Company in the same state. It is believed that they will have some advantages over conventional wooden poles, including resistance to attack by woodpeckers, termites, fungi and even errant motorists.

Wooden poles, which are delivered in Michigan impregnated with creosote at somewhere between \$19 and \$28, depending on the type, have a life expectancy of about 30 years, but in areas where the pileated woodpecker is active it may be reduced to four years or less. This bird roves considerably, but is usually plentiful in Pennsylvania, the Hudson River Valley, Connecticut, Louisiana and other southern states. A company like Consumers Power has about 1¼ million poles in service, and it is said that the Bell Telephone System has around 20 million.

Standard wooden poles weigh from 450 pounds for cedar to 750 for pine.

Those of Fiberglas, on the other hand, weigh only 150 pounds because they are hollow cylinders with closed ends and walls only about $\frac{1}{4}$ inch thick. They can be carried and set in place by two men, as compared with six or seven for the conventional kind. They are expected to sell for more than wooden ones, but may be worth it.

★ ★ ★

Skyscraper Has Normal Pulse

Engineers have taken the "pulse" of the Empire State Building in New York City and found it "normal." The examination, more electronic than cardiac, measured the skyscraper's vibration, a natural phenomenon common to all structures regardless of height. It proved that the world's tallest building has steelier nerves than some of its squattier neighbors.

To conduct the experiment, aeronautical engineers from Minneapolis-Honeywell Regulator Company installed an ultraprecise gyroscope in a central spot on the 85th floor of the 102-story structure. The signals, or measurements, were telemetered to an electronic recorder located 10 miles away in Kingsbridge Armory, where the national convention of the Institute of Radio Engineers was in progress. For purposes of comparison, readings had been taken previously at the Sub-Treasury, the New York Public Library and a 2-story office building.

The Empire State tests, conducted

during a snowstorm and with the wind blowing 30 to 50 miles an hour, showed that the structure has a natural vibration or pulse of between seven and eight times a minute. The Sub-Treasury, the Library and the office building (measured before the storm) all recorded vibrations of 50 times per minute or higher. The engineers explain that this movement is much too slow for the human senses to appreciate that it is taking place.

Natural vibration, they add, is caused by an external force. In the case of a tall structure it is usually variable winds. The squattier ones are more susceptible to such external forces as the subways and street traffic. Thus, while some 40-story buildings affected primarily by wind have been found to vibrate as much as 14 to 25 times per minute, the structures closer to the ground recorded vibrations equaling those in the audio range, or 16,000 to 20,000 times per second. It was pointed out that no building is perfectly rigid, although the Empire State has achieved what engineers regard as maximum stability. Its structural engineers explain that the 365,000-ton skyscraper has an elastic steel frame and can "give" before heavy winds, yet is little affected by them. If it were rigid, the vibration effects would be so pronounced as to be uncomfortable.

The tests also gave an insight into an often-discussed question: "How much does the Empire State Building sway?" During the preliminary experiments its movement off center was never greater

than approximately $\frac{1}{4}$ inch. Under storm conditions, it moved only an inch — $\frac{1}{2}$ inch each way off center. This supports the building's reputation among experts of being an engineering masterpiece.

The measuring element, a gyro known as a HIG (Hermetic Integrating Gyro), weighs less than 3 pounds. It was developed by M-H in collaboration with the Massachusetts Institute of Technology for use by the Air Force in automatic fire-control systems for supersonic and pilotless aircraft. It is hundreds of times more sensitive than conventional gyros. It can detect motion that is one three-thousandth as fast as the movement of the hands of a watch. Or, if a man were to walk in a circle so slowly that the trip would take five years this new gyro could pick up his pace.

★ ★ ★

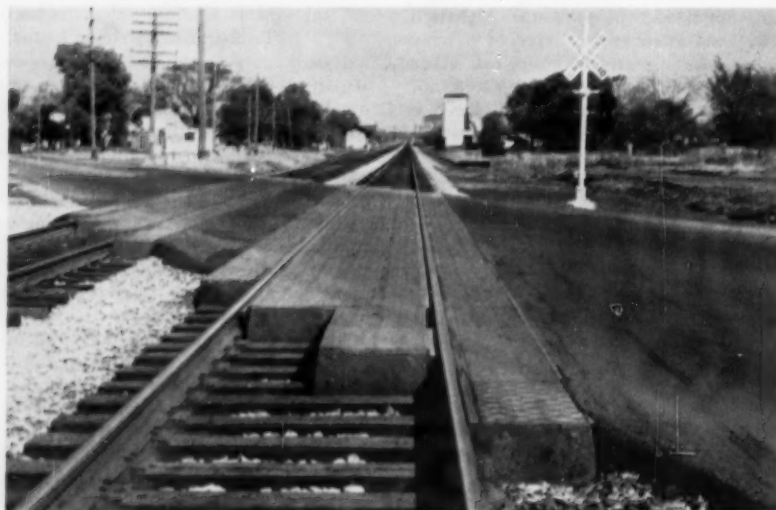
Magnets Save Cows

Bits of scrap metal picked up by cows and swallowed with their feed cause "hardware disease," which kills millions of dollars worth of the animals annually. For some years Alnico permanent magnets have been used to help prevent such material from getting into the feed, but cattle still find enough nails, staples, pieces of wire, etc., around the farm to keep the veterinarians busy. Now the Indiana Steel Products Company, which claims to be the largest manufacturer of permanent magnets, has devised one that goes right into Bossie's innards to capture the cause of her discomfort. In cooperation with Dr. H. U. Cooper, a Roanoke, Va., veterinarian, Indiana's engineers have designed a capsule-like magnet $2\frac{3}{4}$ inches long and $\frac{5}{8}$ inch thick. Pushed down a cow's throat, it remains in the reticulum, or second stomach, and catches most of the ferrous matter that enters. Trials have proved that the device will sharply reduce the need for operations.

★ ★ ★

Fish Really Walk

According to the Curator of Fishes at The Smithsonian Institution in Washington, D. C., some fishes can and do walk either on sea or lake bottoms or on dry land. In such species the lower rays of one of the fins are separated from one another and are controlled by certain muscles to propel the creatures along the bottom in a manner similar to the walking of a mammal on land. The walking or climbing perch that is exhibited in aquariums is termed the fish that walks best of all. But instead of the divided fin rays it has an extra air chamber above the gills that enables it to live for several hours out of water. It has been known to travel overland from one pool to another, covering up to 300 feet in 30 minutes.



RUBBER HIGHWAY CROSSING

Following its successful experimental service in Akron, Ohio, this rubber-clad railroad highway crossing has been laid at the intersection of the Erie Railroad tracks and U.S. Highway 42 at West Salem, Ohio, one of the heaviest-traveled grade crossings in the country. In addition to cushioning the motorist's ride, the Goodyear rubber pads are claimed to reduce skidding in wet or icy weather. The slabs, which contain steel-reinforcing members, rest on wooden supports that bring them to rail-top height and are secured to the ties with lag screws. They form a watertight seal with the rails.

Another Compressor Joins The Gyro-Flo Line

SINCE the Gyro-Flo compressor was introduced by Ingersoll-Rand Company in 1950 it has won wide acceptance and, with the most recent addition, is now available in five sizes ranging in capacity from 125 to 900 cfm. Like the earlier portables of this type, the new 900-cfm rotary air compressor is built for rugged use and incorporates the same features that distinguish the entire line. It is driven by a 6-cylinder General Motors Series 110 diesel engine that maintains its rated brake horsepower at high altitudes and, with its 24-volt battery and ether-capsule system, assures prompt starting at extremely low temperatures.

The latest Gyro-Flo delivers 900 cfm at 100 psi pressure, which is sufficient to operate ten Jackhammers or either seven Wagonjacks with light drifters or three with heavy drifters. Though it supplies 300 cfm more air than the first machine built it is only slightly larger. This is exemplified in the accompanying illustration showing a 600-cfm and a 900-cfm (right) working side by side furnishing air for five wagon drills of which four are seen at the far left.

The portables are among a group of eleven of the same type to be used by



ON THE JOB

Two of the eleven Gyro-Flo compressors supplying air to 27 Ingersoll-Rand FM-3 wagon drills and other pneumatic equipment used by E.J. Petrillo on a 7-mile stretch of the New England Turnpike. The thoroughway will extend from Yonkers, N.Y., to Boston, Mass., and will relieve heavy traffic both on the Merritt Parkway and the Boston Post Road.

E. J. Petrillo, Yonkers, N. Y., contractor on a 7-mile stretch of the New England Turnpike now under construction. His

job involves the excavating of about one million cubic yards of material, including 330,000 cubic yards of rock.

Inspection on a Production-Line Basis

IN COMPLIANCE with the requirements of the American Society for Testing Materials, one section of stain-

less steel from each lot produced is tested to destruction. This method of determining the soundness of metals in the

nonmagnetic class has been improved upon, it is claimed, by Magnetic Analysis Corporation, which has developed a machine that does the work without any damaging effects. A unit of this type is being used by the Alloy Steel Division of Carpenter Steel Company to inspect the quality of rods and tubing.

The operation simply involves feeding each length by power-driven rolls through a magnetic field induced by a coil. If there is a flaw on the inside or outside surface that fact is made known to the operator by a flashing light and audible signal. So warned, he promptly stops the rolls, pushes the stock back through the coil until he again hears the sound and then marks the spot where it occurs.

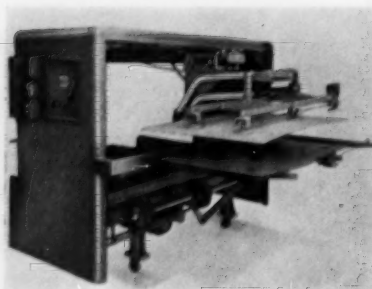
The machine is said to detect scratches, cracks, imperfect or porous welds, pinholes and, under favorable conditions, variations in wall thickness of as little as 3 percent. If by chance a tube run through differs in size and composition from those being tested, the instrument will give a continuous signal. It can be set to disregard imperfections below a given value, depending upon the quality of product specified. Tubing up to 3 1/4 inches in diameter and 0.07 inch in wall thickness are being checked at the rate of 250 feet per minute.



PLASTIC PELLETS UNLOADED WITH AIR

Customers with suitable storage bins can now receive supplies of Eastman Tenite polyethylene in a new way. From airtight compartments in a truck such as the one shown the spherical pellets are blown into the bins through a pipe line. The truck carries its own air compressor, which normally supplies 1200 cfm of air to float the material through an aluminum pipe, which should preferably be not more than 100 feet long. Bins with a storage capacity of 15 tons each are recommended and must be provided with screened vents to exhaust the air entering with the pellets. This bulk-shipment service is provided by Eastman Chemical Products, Inc., and is available in all states east of the Mississippi River except in a part of Florida and in three states west of that waterway.

Industrial Notes



Self-contained and movable, the sheet feeder shown is completely automatic in its operation. Designed by Hamilton Automation, Inc., it is air-powered by 110-volt electrical controls that can be interlocked with those of a heavy-duty metal-stamping press. It is designed to handle work ranging from a blank 8 inches in diameter to a 48x144-inch sheet and is said to feed up to 30 sheets a minute, depending upon their size.

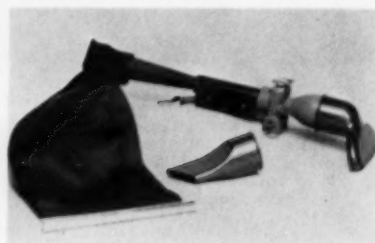
Circle 1E on reply card

Two construction men have invented an alarm system for trucks that operates automatically as soon as a vehicle is backed up. It consists of a 6-inch metal bell that is surrounded by four small hammers and mounted on the axle hub. The hammers do not ride on the bell;

they are held away from it by springs which prevent them from striking the bell when the wheels are moving forward. The device is being tested by the Corps of Engineers, U.S. Army.

Circle 2E on reply card

For industrial service wherever compressed air is available U. S. Engineering & Mfg. Company is offering its Model 101 vacuum cleaner that converts air pressure into suction without moving parts. It is based on a patented jet-action principle and incorporates an auxiliary blowgun. Named Vacu-Blo, the unit weighs only 2¼ pounds. It comes with two nozzles; one for flat surfaces and the other for work in confined areas. The collector bag is made from extra-



heavy Rhino cloth with a leatherette collar at the inlet to lessen the impact of abrasives, chips, borings, etc., when working around fabricating machines and grinders. Using compressed air, the cleaner functions with safety in the presence of flammable dust and explosive atmospheres such as are found in chemical plants and grain mills and elevators. It is recommended for cleaning stock bins and tote trays and for overhead jobs.

Circle 3E on reply card

Wire cloth is being woven by a new loom that is said to be an improvement over older types as to speed and efficiency of operation. It has ball and roller bearings throughout, is push-button controlled and functions automatically. On 36-inch fabric it is said to work nearly 10 percent faster than do conventional machines. Known as the Franz antifriction loom, it was invented by Bent Weaver, presi-

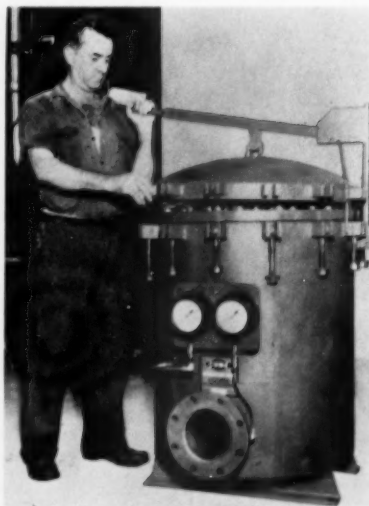
dent of the Mount Wolf, Pa., plant of the American Wire Fabrics Corporation, and is named after A. F. Franz, president of the parent company—The Colorado Fuel & Iron Corporation.

Circle 4E on reply card

A new hose made of synthetic materials throughout has been put on the market by the Quaker Rubber Division of H.K. Porter Company, Inc. It is said to be the first of its kind that can be used effectively at high temperatures in keeping jet engines heated and ready for take-off. According to the manufacturer, it is capable of handling air continuously at temperatures up to 400°F and working pressures of 100 psi and, because of its lightweight, flexibility and exceptional strength, is suitable for many industrial applications. The hose can be furnished in inside diameters from ¾ inch to 5 inches in lengths up to 50 feet.

Circle 5E on reply card

New filter housings designed especially for high-capacity, diesel full-flow lube systems have been announced by The Cuno Engineering Corporation. The cartridges used with them are of the company's Micro-Klean replaceable type of graded-density construction—5-, 10-, 25- or 50-micron filtration—and are quickly changed by one man who simply drops the swing bolts that hold down the cover, lifts the arm attached to it and swings the top aside. Flow rate of the QS Series is said to be high. The largest unit is 2½ feet across flanges, 4½ feet high and has a capacity of 500 gpm of clean oil at 150 SSU, 25-micron filtration with a pressure drop of only 2 psi; the smallest measures 2x2¼ feet and handles 80 gpm under the same conditions.

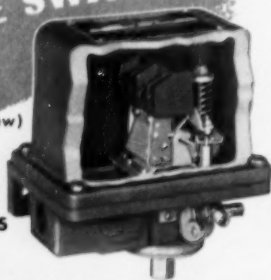


Circle 6E on reply card

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(cutaway view)

**FOR AIR COMPRESSORS
AND PUMPS USED IN
HAZARDOUS LOCATIONS**



THESE FEATURES

ADD UP TO A BETTER SWITCH:

- 200 lb. range and usual differential for air compressors and pumps
- Tamper-proof adjustment
- "Power-house" over-center spring fixed for positive action regardless of switch adjustment
- Externally mounted release valve protects against corrosion of internal parts

Also available in **WATER-TIGHT** construction

Write for Bulletin 9013-G.

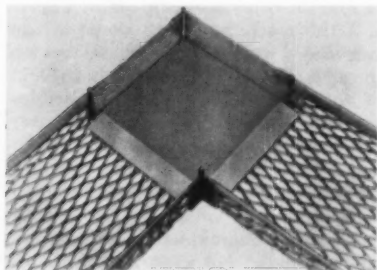
Address Square D Company,
4041 N. Richards St., Milwaukee 12, Wis.



SQUARE D COMPANY

Circle 16A on reply card

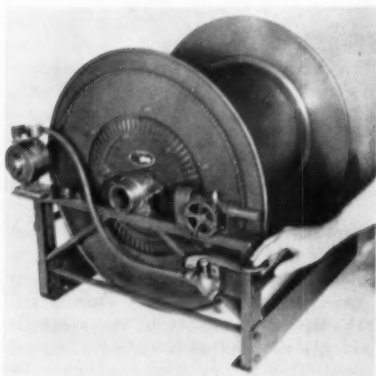
A simplified coupling to speed the installation of its Cable Trough has been announced by T.J. Cope, Inc. The new connector reduces the number of pieces required for one joint from thirteen to



three: two pins that are just dropped in place and a plate that fits both over and under the trough to protect the cables. The accompanying illustration shows a solid corner connection (also available in expanded metal) that is suitable for flexible cable and is secured to the troughs by the new pin-type coupler.

Circle 7E on reply card

A newly designed hose reel for fuel delivery trucks and industrial applications introduced by Clifford B. Hannay & Son, Inc., has a compressed-air rewind that recommends the unit for use especially in dust-laden or explosive atmospheres. The assembly consists of an air motor connected by an air line to a control valve with a built-in back-



pressure relief valve. Minimum line pressure of 105 psi is required. To rewind payed out hose the operator presses on the control lever, thus powering the motor that drives the revolving drum. Release of the lever immediately cuts off the motor and stops the reel. Truck-mounted units or those in hard-to-reach places can be equipped for remote control. Reels of this type are available for hose up to 3 inches inside diameter.

Circle 8E on reply card

Sikacrete is the name of a concrete additive recommended by Sika Chemical Corporation for pouring subsurface structures and machinery bases. It is

said to hasten setting, to reduce shrinkage and to increase water resistance and surface hardness.

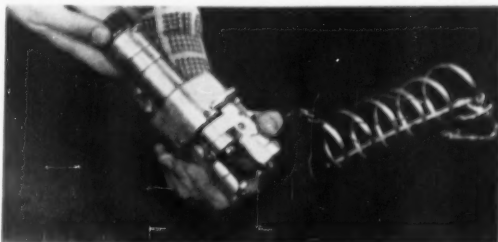
Circle 9E on reply card

Precast-masonry stacks suitable for use with boilers, furnaces, ovens, retorts and incinerators and for in- and outdoor installation have been announced by Van-Packer Corporation. They are made in six diameters (10 to 24 inches ID, 14 to 30 inches OD) and in 3-foot sections that are permanently joined and sealed by an acidproof, high-temperature cement. The entire assembly is covered with 0.02-inch sheet aluminum, which requires no painting or maintenance. Two grades are available: Standard and Hi-Temp, for temperatures up to 800 and 1600°F, respectively, based on continuous exposure to flue gases from coal, oil or gas fuels. A chimney with 2½ sections standing free above the uppermost lateral support is said to withstand winds of 100 miles an hour.

Circle 10E on reply card

Insulation can be stripped with ease from round, flat or square wire, it is claimed, by a portable tool offered by Newark Brush Company. It is equipped

with two wire brushes that are driven by an air motor and rotated at the rate of 4000 rpm. The wire to be prepared for soldering is inserted through an opening in a guard around the brushes, which are brought together and released by a hinged assembly and spring. Including the stripping head and motor, the tool has an over-all length of 11 inches and weighs only 3¼ lbs. Brushes are available in a wide range of wire sizes (even in cloth for extra-fine electric wire) for removing cotton, silk, enamel, Formvar, Formex and other insulating materials from the finest

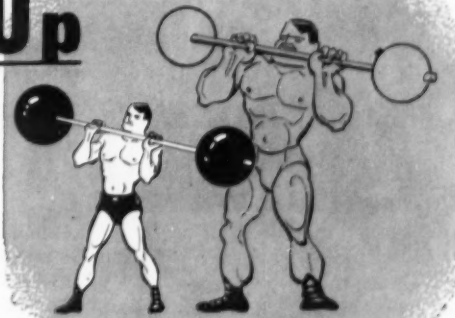


to No. 4 gauge wire. Air at a pressure of 80 to 90 psi is used and can be taken from a shop line provided with a filter and oiler. The stripper can be converted into a stationary unit by a special stand.

Circle 11E on reply card

Fast and accurate inspection of lead, elevating and other similar screws either

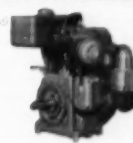
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You don't need "beefy" bulk to get brawn... nor size to insure stamina. Built for the work you want them to do, sized to fit your equipment most readily, Wisconsin Heavy-Duty Air-Cooled Engines offer a variety of design and performance advantages.

Every Wisconsin Engine (3 to 36 hp.) has the inbuilt "lug-ability" to slug it out in the roughest company... and in this performance, Wisconsin's advanced concept of heavy-duty engineering in a compact power package plays an important role in direct relation to the design and operating requirements of the original equipment builder.

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3 to 6.8 hp.



6 to 9 hp.



7 to 15 hp.



15 to 36 hp.



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Two Sure Ways to Prevent Air Loss



"AIR KING" Quick-Acting HOSE COUPLINGS



For All Hose Connections

These plain rugged couplings are your surest safeguard against loss of air at the hose connections. Universal locking heads, on sizes up to 1", snap together to form a secure lock that is leak-proof under pressure; in fact, pressure must be released before coupling can be disconnected. Ideal for rough outdoor work as well as indoor shop and plant service. Malleable iron, cadmium plated, and bronze. Hose Ends, Male and Female I.P.T. Ends. Size range, 1/4" to 1". Also available in 4-lug type, not universal, in 1 1/4" to 2" sizes.



"BOSS" Self-Honing AIR VALVES

For the Entire
System

The most efficient and economical valves for all valve stations on the system—automatically, permanently leakproof—no packing to wear out and replace—straight-line, full-flow opening through body and plug. Self-adjusting bronze plug automatically hones itself against harder steel or malleable iron valve body, maintaining a perfect leakproof seat. Proper spring tension assures constant sealing adjustment. Strong, durable construction, with handle attached to plug within the valve body. Male or female thread both ends, in sizes 3/4" to 1 1/2".

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of Industrial Rubber Products

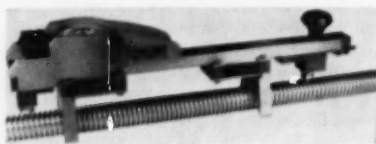
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Buck Iron Company, Inc., Garyville, Pa. · Phoenix Green Steel Company, Camden, N.J.

Circle 18.4 on reply card

ADV. 21

(154)

on or off machines is possible, it is claimed, with a new portable testing comparator being made by Jerpbak-Bayless Company. The standard instrument is 12 inches long and capable of



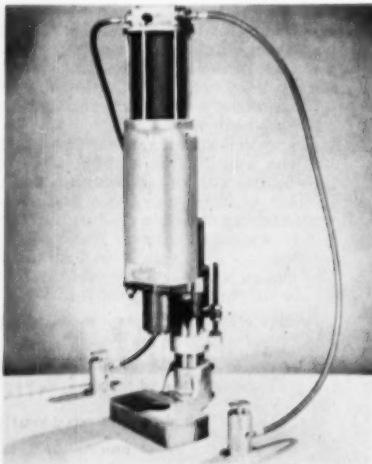
measuring thread diameters from 7/8 inch to 2 1/2 inches in any pitch. It can be quickly set to conform to a master screw and shows results on an easy-to-read dial. Self-aligning, the gauge will help builders, rebuilders as well as users of machine tools to check for accuracy or wear and manufacturers of screws to inspect the work anytime during process of production.

Circle 12E on reply card

Disposing of green wood on large construction projects is no longer a problem, it is claimed, with the No. 75 Rotomist built by the John Bean Division of Food Machinery & Chemical Corporation. Actually a huge bellows on wheels, it blows a maximum of 20,000 cfm of air a distance of 125 feet. In attacking a pile of wood ignited by a flame thrower, the unit is first set at half throttle so as not to extinguish the flame. Once the fire is well started the Rotomist is turned up and the air is directed against the ground in front of the stack. Should it die down, the operator can introduce droplets of oil in the air stream to rekindle the blaze. It is reported that big piles of green wood can thus be reduced to ashes in short order.

Circle 13E on reply card

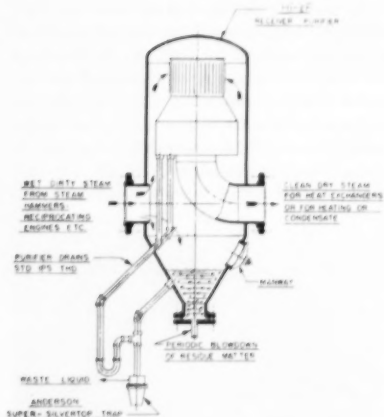
For light staking, forming and other secondary work in which speed and precision are factors, Winter Products, Inc., has added a new model—RR-7A—to its line of controlled-power pneumatic safety presses. Among the improvements



incorporated in the bench-mounted unit is a control system consisting of a double-pilot 4-way valve mounted on the air-cylinder head. It is actuated by two 3-way hand valves, one normally on and the other normally off, and operates the machine on the down stroke and a new type air blowoff system on the up stroke. Holding down either hand valve causes the press to stop functioning until that valve is released. Another feature is a combination elevating mechanism and key that both raises and lowers the head and maintains its angular position on the column. The RR-7A has a cast-aluminum base with a 2-inch-diameter relief hole and is said to deliver an accurately controlled impact from 0 to 12,000 psi, or a squeeze up to twelve times the air-line pressure.

Circle 14E on reply card

For the purpose of purifying exhaust steam so it can be reused in heat exchangers and unit heaters or for heating condensate, The V.D. Anderson Company has designed a Hi-eF purifier of



the receiver type. All condensate, oil droplets and mist are intercepted by a 2-stage method of separation based on a new patented principle. During the first stage the velocity of the steam is suddenly reduced as it enters a special drum. This action, combined with the design of the drum, causes the larger drops of condensate and other matter to precipitate. Next the exhaust steam flows through a multistage element which removes the mist by centrifugal force. The heavy material collects in a hopper for periodic blowdown; the liquid continually drains into a trap. The accompanying diagram shows an installation in a steam-hammer shop where it serves to separate shreds of shaft packing, lubricating oil, line scale, condensate, etc., from the exhaust steam. It handles a maximum load of 70,000 pounds per hour and a minimum of 3000 pounds at 8 psig operating pressure. The end product is distributed to unit heaters with satisfactory results, it is reported.

COMPRESSED AIR MAGAZINE

The Hi-eF units are fabricated with various in- and outlet arrangements for pipeline sizes from 4 to 16 inches and for pressures up to 300 psig. Larger purifiers for special uses are available.

Circle 15E on reply card

As a substitute for alloys, The Garlock Packing Company is offering an inexpensive lining and surfacing material for pipes, tank cars, containers of all kinds, laboratory counters, floors, conveyor belts, etc. It is a laminate of non-porous Kel-F plastic that is fused and spread on a backing of glass-fiber cloth. It actually flows into the fibers, of which enough remain exposed on the reverse side to provide a gripping surface for conventional adhesives. The material can be applied on the job to well-nigh any contoured surface. It is said to be highly resistant to acids, alkalis, oxidants and solvents, as well as to high and low temperatures and abrasion and to be nontoxic, noncontaminating and nonsticking. The finished sheet is 0.02 to 0.03 inch thick and comes in sizes up to 36x46 inches.

Circle 16E on reply card

QUOTES

—FROM HERE AND THERE

First Fatal Automobile Accident

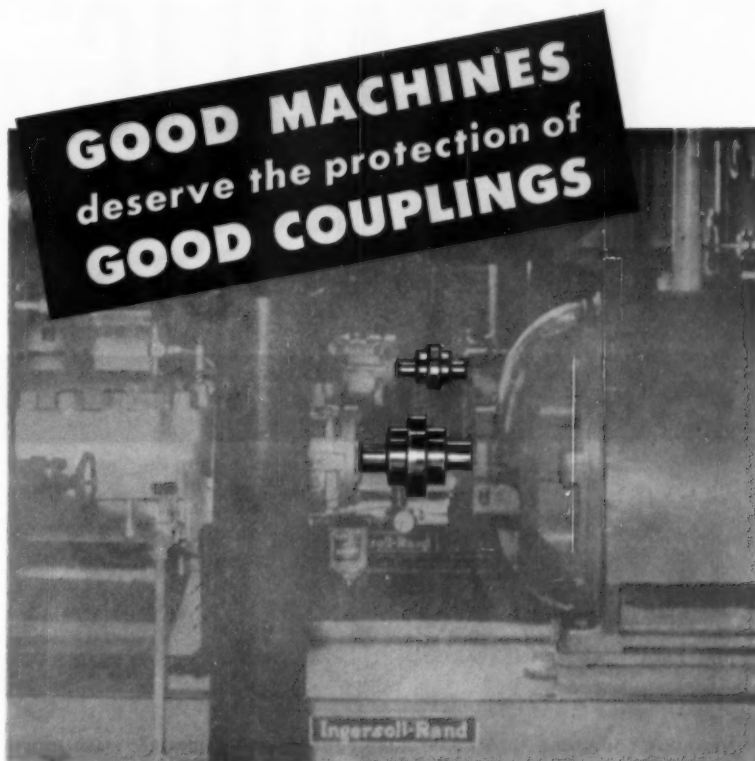
"The first recorded fatal traffic accident (automobile) in the United States was the result of an almost unbelievable coincidence. The only two motor cars in the State of Ohio in 1895 arrived at the same intersection at the same time, resulting in a crash that killed one of the drivers. Since that time automobile accidents have caused the deaths of more than one million people in the United States."

Fleet News, March 1956

Air Ejects Cap If Unlined

"Bottlers need a reliable way to detect the absence of the paper-board liner in bottle caps. Occasionally, the liner may be left out by the cap manufacturer. In other instances the liner may fall out before the cap is applied to the bottle. Reliable detection is important primarily because other bottles in a filled case may be damaged when a 'leaker' spills its product in shipment or storage.

"The cap is usually inspected when it is packed into the shipping carton by the cap manufacturer, and when it is fed into the capping machine. Since the absence of a liner can only be detected by 'looking,' the installation of a reflection type photoelectric scanner has been a natural solution. On one small unit, the scanner incorporates both light source and phototube with a common lens system. As the caps move past in a con-



...and they get it with



The motor driven boiler feed pump application pictured above needs a WALDRON coupling to make it a top engineering and mechanically perfect installation.

That's why WALDRON is being specified by more and more pump and compressor manufacturers.

SHEAR PIN ... CUT-OUT ... FLOATING SHAFT ... SPACER ... OIL COLLECTOR
CONTINUOUS LUBRICATED ... PLUS OUR HS HIGH SPEED COUPLING

Complete details in Catalog 57

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Circle 19A on reply card

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METHOD OF PIPING

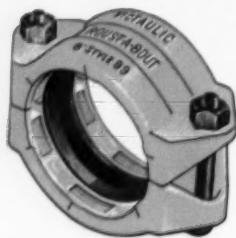


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VICTAULIC COUPLINGS

Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".



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For plain or beveled end pipe Style 99. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 8".



VICTAULIC SNAP-JOINTS

The new, boltless, speed coupling, Style 78. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB



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Elbows, Tees, Reducers, Laterals, a complete line—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



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Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

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"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.

Write for NEW Victaulic Catalog-Manual No. 55-B5

VICTAULIC COMPANY OF AMERICA
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Circle 20A on reply card

tinuous line, the scanner 'looks' into the open ends, instantly recognizing the difference in reflection between the dark liner and the light coloured cap. When it detects a defective cap, the photoelectric relay operates the ejector device, an air blast controlled by a solenoid valve. The duration of the air blast is so accurately controlled by an electronic timer that none of the caps before or after the defective cap are displaced. It is claimed that this high-speed photoelectric inspection system keeps pace with rapid production and provides 100 per cent quality control at low cost."

Compressed Air Engineering (London)

October 1955

BRIEFS

Anyone traveling the New York Thruway can call Albany 5-3393 and will receive from an answering device a report on weather and driving conditions along the full length of the highway.

The two lowest bidders on a road-building project in Colorado that will cost more than \$400,000 were just \$1.50 apart. "They can't do the job for that price," exclaimed a member of the firm that was nosed out.

More than 750 million aerosol units have been sold during the past ten years. Though all were under gas pressure, accidents have been practically unknown.

The largest underground mine is claimed to be the Braden in Chile, which produces mostly copper and employs 10,000 men. It mills 35,000 tons of ore daily. The Climax Molybdenum Mine in Colorado treats 30,000 tons.

In machining rolls for papermaking equipment on a tracer-controlled lathe, Improved Machinery Inc., of Nashua, N. H., removes 18 pounds of metal per minute with a tungsten-carbide tool. Roughing cuts are ⅝ to ¾ inch deep at turning speeds ranging from 500 to 800 feet per minute.

Included in the Second Annual Atomic Exhibition in Washington, D. C., last month was the "slave manipulator," a mechanical hand used to shift "hot" materials behind a wall in an atomic reactor. The device is said to be able to thread a needle or light a cigarette.

Great Salt Lake is being tapped by Kennecott Copper Corporation to loosen haulage tracks that freeze down tight in winter in Bingham Canyon. It used to be a hard and destructive job with picks and shovels, even with flame throwers and dynamite, to shift rails as the ore banks are cut back. But now they are freed with relative ease by

means of a special car that spreads dry salt along the tracks and by two converted steam-locomotive tenders, with a capacity of 12,000 gallons, which drench them with water obtained from the lake.

The world's wettest spot may be Mau-shynram Village in India, which had 535 inches of rain in nine months last year. The total for July alone was 198 inches.

Western Union Telegraph Company observed its hundredth anniversary in April. It was founded at Rochester, N. Y., by uniting four smaller concerns—hence the name Western Union, suggested by Ezra Cornell.

Now you can buy corrugated cartons with zippers placed where you wish to facilitate unpacking. That is not the main purpose of the feature, however. The Zip-Open Tape with a pull tab is designed to prevent the contents from being damaged by the knife or other sharp instrument now commonly used to open shipping containers of this type.

Alert to the special needs of shippers, the Nickel Plate Road has introduced what it calls a basket car to transport forgings from Canton, Ohio, to a Detroit, Mich., auto assembly plant. An adaptation of a flatcar, it has room for 24 wire containers which, when full, weigh approximately 60 tons. Using fork-lift trucks, it takes 35 minutes to load a car, it is reported.

The 1955 fish catch in the United States and Alaska approximated 4.6 billion pounds, for which fishermen received \$324 million, about 10 percent less than in 1954. Nonedible menhaden made up about 40 percent of the 1955 haul. Production of fish sticks, a recently created specialty, reached a new high of 70 million pounds.



"If the traffic would let up a little we'd be just about on time for the next shift."

18 TYPES OF PRODUCTS TO MEET YOUR SPECIFIC NEED

Here's a GALAXY OF FRANCE PACKINGS and PISTON RINGS

used by

LEADING COMPRESSOR BUILDERS
gas, oil and chemical companies

- General Type Packings • Hyper Compressor Packings • Refrigeration Packings • Steam Packings
- Gas Engine Packings • Sheathed Bronze Fire Checks • Oil Wiper Packings • Hi-Lead Bronze Packings • Carbon Packings
- Carbon-Bakelite Packings • Valve Discs (Steel & Bakelite) • Carbon Bakelite Segmental Piston Rings
- Bronze Segmental Piston Rings • Carbon Bakelite Piston Rings
- Liquid Pump Piston Rings • Power Piston Rings • Chrome Plated Piston Rings • Teflon Piston Rings . . .

and many other types of rings and packings for special operations.

FRANCE

Packing
Company

Phila. 15, Pa.

SINCE
1898

For Full Information — MAIL COUPON NOW!

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PHILA. 15, PA.

Name

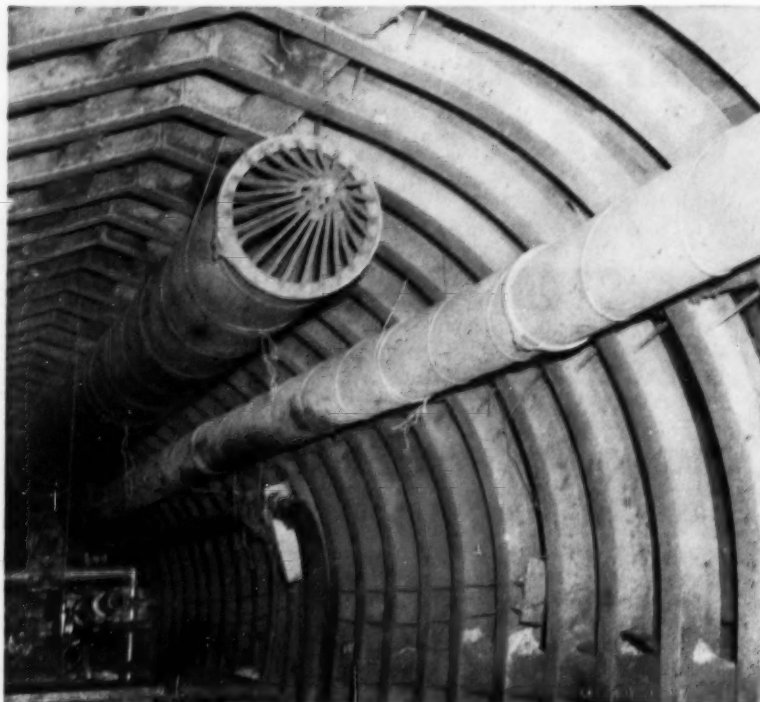
Title

Company

Address

Circle 21A on reply card

SHORT CUT THAT CUTS COSTS



With the accent on speed in construction work, Naylor pipe has proved a practical help in providing a dependable short cut on ventilating lines.

The combination of this lockseamed, spiralwelded pipe and the one-piece Naylor Wedge-Lock coupling gives you lines that can be installed faster and easier than by other methods. The light weight of the pipe not only speeds the installation but, in addition, the exclusive Naylor structure permits the use of lighter gauge material which reduces costs without sacrificing performance. High salvage and re-use value are other economy factors to consider, too.

For moving air and water and for other materials handling jobs, it will pay you to look into all the advantages offered by Naylor pipe and Naylor Wedge-Lock couplings. Write for Bulletins No. 507 and No. 514.

NAYLOR PIPE



NAYLOR PIPE COMPANY

1245 East 92nd Street
Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 22A on reply card

Books and Industrial Literature

In our May 1955 issue we reviewed a book entitled *Moving the Earth* by Herbert L. Nichols, Jr. Of 1280 pages, it is the most complete work on the subject ever published. Now, in answer to a demand for a less expensive volume to meet the special needs of construction and engineering field men, the author has compiled *Modern Techniques of Excavation* which gives complete information about planning and carrying out excavation and grading projects of all kinds but does not include structural details about the equipment used and their basic operation. There are also chapters on financial management, estimating, insurance and certain aspects of equipment maintenance, as well as a glossary containing definitions of more than 1200 terms used in the industry and an appendix of technical data reproduced from the larger volume. Published by North Castle Books, 212 Bedford Road, Greenwich, Conn. Price, \$9.00.

With the quarry operator, road contractor and construction man in mind, Ingersoll-Rand Company has prepared a 32-page bulletin descriptive of its new Drillmaster, a self-contained rig that is designed to drill blastholes by interchangeable methods. Equipped with its Depth-Master, which goes down the hole with the bit, it puts down 6- to 6½-inch holes up to 125 feet deep, and with the Roto-Master (rotary) drill, 4 ¾- to 6¼-inch holes up to 125 feet deep. All are fully explained and illustrated, as well as the three types of mountings available: crawler, truck or tractor. Included are several pages of helpful data on estimating rock-excavation jobs. Address your request for a copy on company letterhead to the nearest Ingersoll-Rand office or to J. K. Uhler, Ingersoll-Rand Company, Phillipsburg, N. J.

Complete details about its line of Y-type cast semisteel and carbon moly-steel pipe strainers for pressures up to 250 and 900 psi, respectively, are contained in Bulletin No. 602 released by Armstrong Machine Works.

Circle 17E on reply card

Airmatic Valve, Inc., has published a quick reference guide to seventeen different lines of air-control valves and accessories to help designers select the one that meets specific requirements.

Circle 18E on reply card

Questions such as why dust collectors are essential to industry and how they can be used are answered in a 16-page booklet that pictures and describes Torit Manufacturing Company's line of cabinet cloth-filter and cyclone separator-type dust collectors.

Circle 19E on reply card

A technical report compiled by Warner Electric Brake & Clutch Company gives an analysis of the features and operating advantages of its custom-engineered fan clutches for internal-combustion engines on trucks, automobiles, construction machinery and stationary equipment.

Circle 20E on reply card

Bulletin 234-C, recently announced by American Air Filter Company, Inc., explains the operation, construction, application and performance characteristics of its Auto-Airmat, an automatic, dry-type air filter designed especially for textile mills, newspaper pressrooms, food processing, sugar refineries, hospitals and atomic-energy installations. The filtering media is a porous

tissue-thin sheet of felted fibers fastened like a window shade at the top of filter sections from 5 to 15 feet high. As heavy lint, ink mist and other air-borne concentrations collect on the paper it is rolled up at the bottom for easy disposal.

Circle 21E on reply card

The Repair of Cast Iron Parts is an illustrated booklet containing the latest information on the welding of cast iron with Ni-Rod and Ni-Rod "55." Published by The International Nickel Company, Inc., it gives nine graphic case histories of the electrodes in action.

Circle 22E on reply card

Bulletin 130 released by Niagara Blower Company describes and illustrates with diagrams and photographs the functions of its Aero After Cooler in removing moisture from compressed air and other gases. The use of the apparatus in connection with air-liquefaction systems is also discussed.

Circle 23E on reply card

Bulletin H1008 released by The Bristol Company deals with its portable Thermo-Humidigraph instruments for recording both relative humidity and temperature of areas in which they are placed. Models to be mounted permanently also are shown, as well as samples of typical records made.

Circle 24E on reply card

Brochure No. 602 offered by Conforming Matrix Corporation illustrates and describes its new automatic air-operated, single-spray decorating machine with a workholder that can often serve as a mask. Of the portable type, it can be used in most standard exhaust spray booths for short or long runs.

Circle 25E on reply card

What is believed to be the most complete single bibliography of current periodical references to powder metallurgy has been compiled by the Harper Electric Furnace Corporation, manufacturer of continuous sintering furnaces. Nearly 250 articles and papers printed in American, Canadian and English technical journals and trade magazines are listed and cross-indexed.

Circle 26E on reply card

Section A of a general catalogue released by Sauerman Bros. Inc., deals with its standard and rapid-shifting Dragscrapers, track cable machines and tower excavators. Divided into five sections for easy reference, it gives mechanical and operational data and numerous on-the-job pictures and layouts of typical installations handling sand and gravel, overburden, chat, etc.

Circle 27E on reply card

Standard electric heaters and heating devices are covered in detail in a 60-page bulletin, GEC-1005G, offered by General Electric Company. Types listed range from immersion, strip, cartridge, tubular, fin and railroad-switch heaters to soldering irons, glue and soft-metal melting pots, oven equipment and unit heaters. An application index shows methods of heating and types recommended for different processes.

Circle 28E on reply card

How to select the right fire hose for safety and long life is pointed out in a data sheet published by The B. F. Goodrich Company's Industrial Products Division. In addition to giving facts about eleven types, it describes Superseal, its new chemical treatment which protects hose against mildew, rotting, moisture absorption and freezing, as well as Plylock which is said to add 100 percent more strength to hose ends.

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Changing the Face of the World with CONTINENTAL RED SEAL POWER



**MOBILITY PLUS
VERSATILITY**

**WARNER & SWASEY
MULTI-PURPOSE
GRADALL
WITH CONTINENTAL
RED SEAL POWER
IN TRUCK AND IN
UPPERSTRUCTURE**

Wherever you go these days, you see men at work re-shaping the landscape with the aid of modern construction machines. And no matter what the specific job—clearing land, ditching for irrigation, grading for railroads and highways, laying pavement or wrecking buildings—you'll note a pronounced swing, of late, to equipment with Continental power. The adoption of dependable Red Seals—gasoline or Cushioned Power Diesel—by more and more builders of construction and industrial equipment, reflects a spreading recognition, on the part of machine users, of this basic fact: There's a vast difference, in performance, dependability, economy and upkeep cost, between the ordinary engine and the Continental Red Seal that's engineered and built for the job.

SERVICE FACILITIES AND RED SEAL PARTS AVAILABLE EVERYWHERE

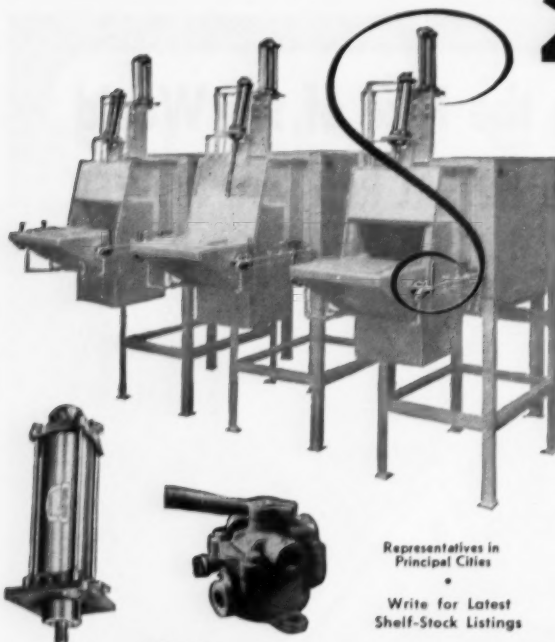


Continental Motors Corporation

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6218 CEDAR SPRINGS ROAD, DALLAS 9 TEXAS • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

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Hevi Duty Electric Co., Milwaukee, builder of Electric Heat Treating Furnaces, has found that NOPAK Cylinders and Valves can be depended upon for the many years of trouble-free service which users expect of Hevi Duty Furnaces. Not once in 20 years has a Hevi Duty customer returned a NOPAK Component for replacement.

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DESIGNED for AIR and HYDRAULIC SERVICE

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A 8653-1/2 H

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Do you know when your air tools or compressor are in need of repair or replacement?

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TOOL-OM-ETER or DRILL-OM-ETER
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Why not investigate the advantages our TOOL-OM-ETER or DRILL-OM-ETER can give you, both in cutting costs and in improving maintenance schedules?

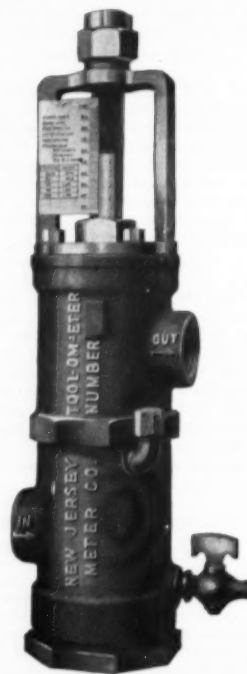
Write for Bulletin A-8

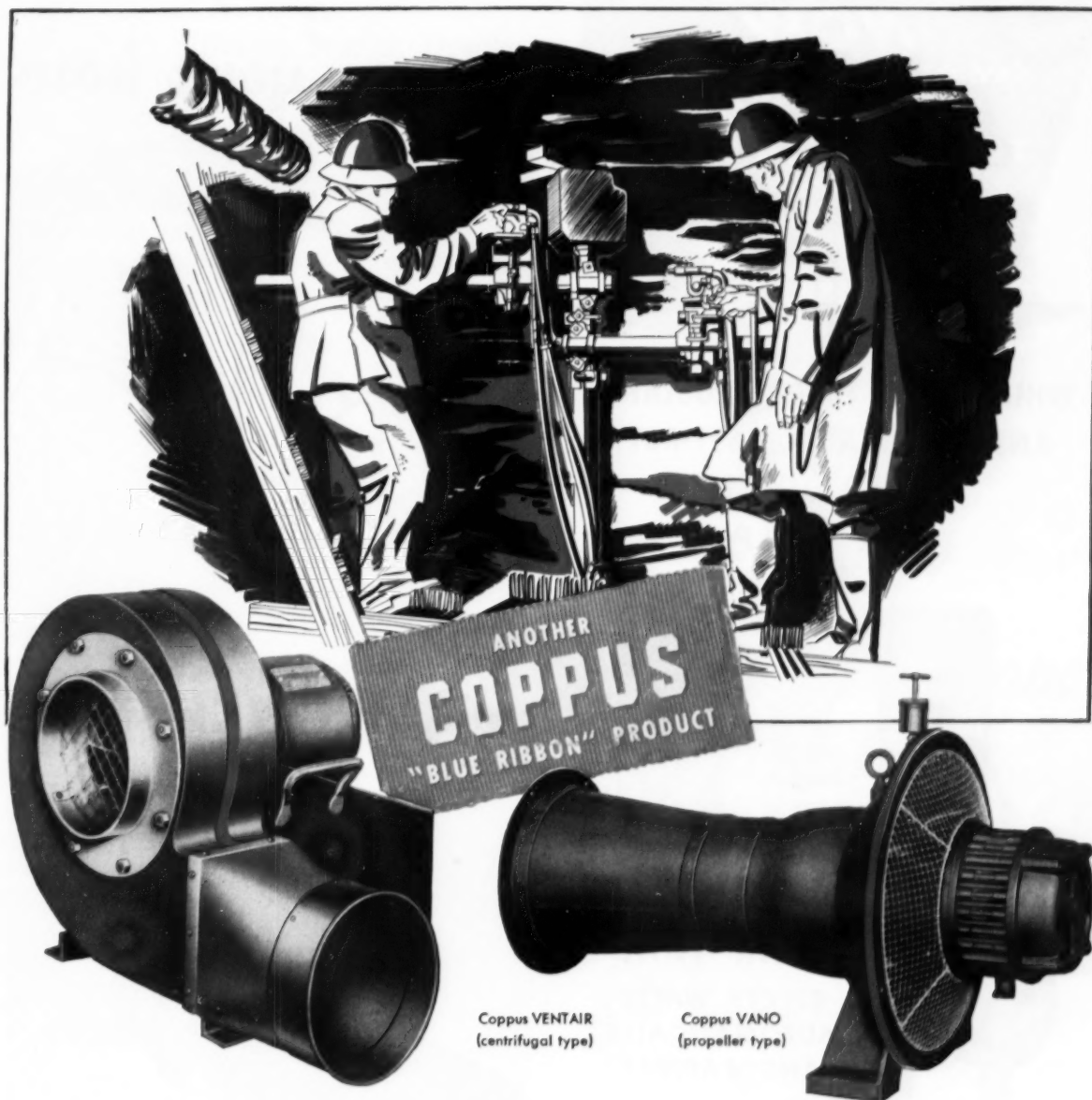
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"Specialists in Compressed Air Devices"

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Coppus VENTAIR
(centrifugal type)

Coppus VANO
(propeller type)

Choose between them and get 30% to 100% more air

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Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters

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PROTECTION
TO YOUR AIR LINE
with the outstanding

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AND LUBRICATOR ASSEMBLY
and AUTOMATIC
AIR TRAP**
MODEL W-4



AIR TRAP
EJECTS WATER
AUTOMATICALLY
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The **FILTER** removes solids .00039 and larger. Transparent bowl provides visibility. The **REGULATOR** can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact. Machined from bar aluminum.

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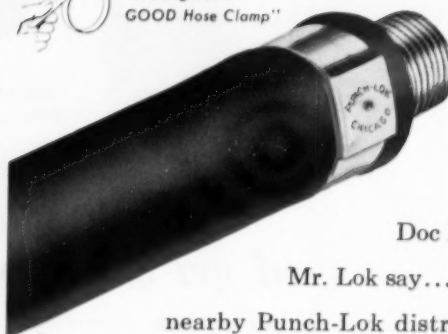
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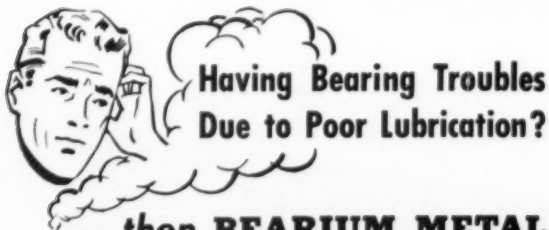
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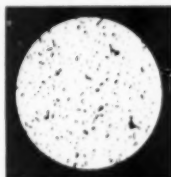
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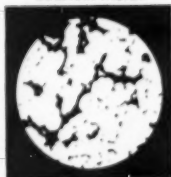
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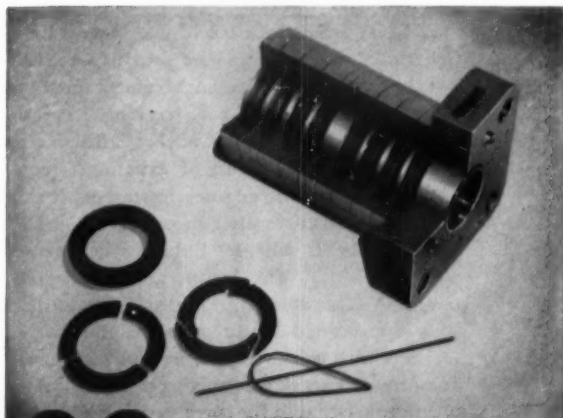
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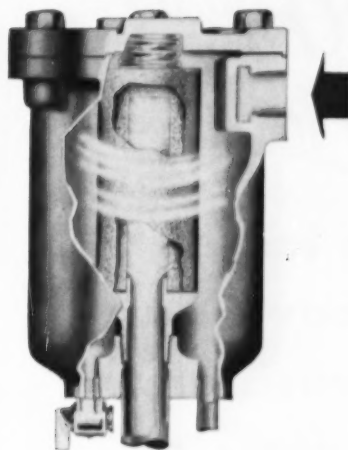
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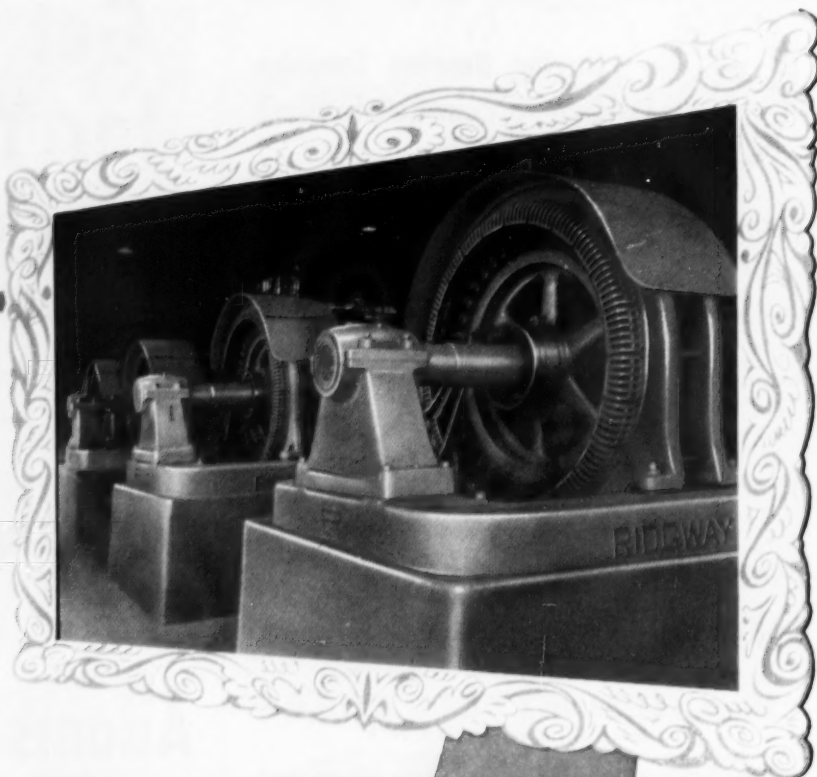
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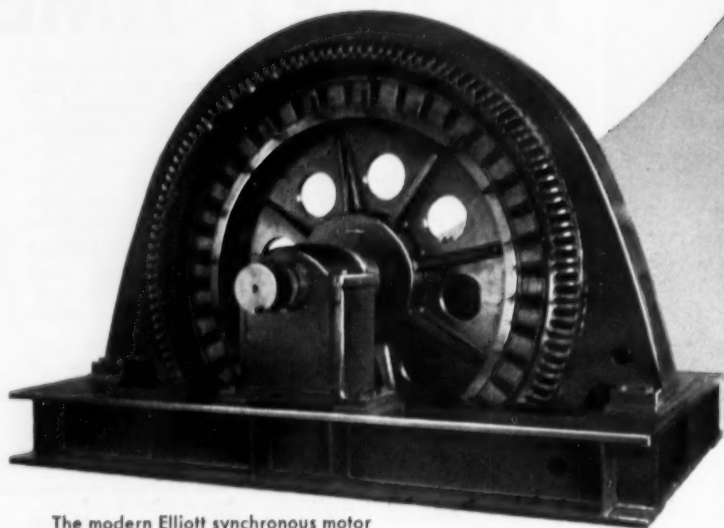
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RG-2



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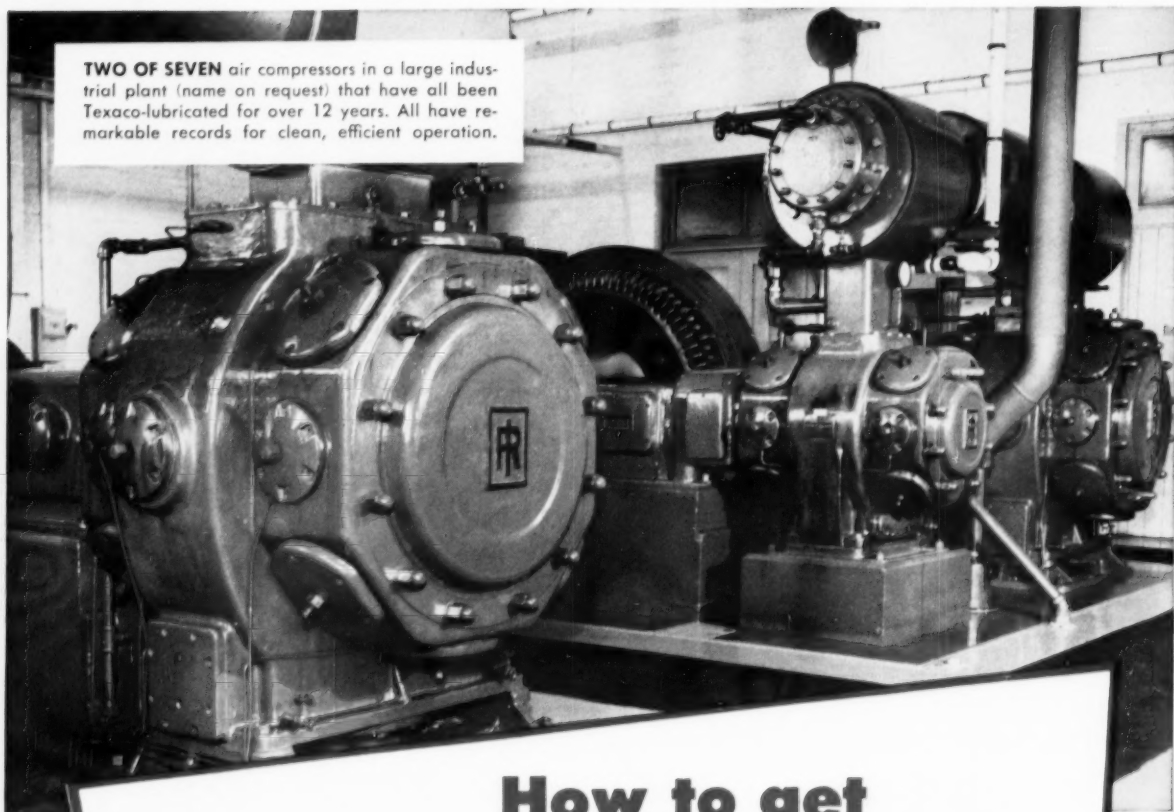
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